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Identification of Aircraft Hazards

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001	Incorporates Nellis AFB information and other miscellaneous comments from Sandia National Laboratory, YMP Licensing, and the YMP Executive Oversight Group.
002	Incorporates DOE review comments and refinement of screening criteria. This revision contains extensive changes, therefore, revisions bars have not been used.
003	Corrective Action for CR-4992, and improvements as identified in the Engineering Product Review.
004	Correct cover sheet, minor editorial changes and additions for clarity in response to CR-5114.
005	Editorial corrections.
006	Editorial error in Reference section identified by QA Audit/Surveillance Number BQAC-BSC-05-16, Issue Number 11 documented in CR-5615.
007	Revise and expand discussion on cruise missiles and electronic jamming activities. Corrective Action for CR-5544. Editorial changes. The editorial changes have not been marked with revision bars.

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AGL	above ground level
AIM	Air Intercept Missile
ARTCC	Air Route Traffic Control Center
ATCAA	air traffic control assigned airspace
DOE	U.S. Department of Energy
EC	electronic combat
ECR	electronic combat range
FAA	Federal Aviation Administration
IFR	instrument flight rules
KCAS	knots calibrated airspeed
KTAS	knots true airspeed
LATN	low altitude training and navigation
MGR	monitored geologic repository
MOA	military operations area
MSL	mean sea level
MTR	military training route
NTS	Nevada Test Site
NTTR	Nevada Test and Training Range
USAF	United States Air Force
VFR	visual flight rules
VORTAC	Very High Frequency Omnidirectional Range Collocated with Tactical Aircraft Control and Navigation

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1. PURPOSE

Aircraft hazards were determined to be potentially applicable to a repository at Yucca Mountain in *Monitored Geological Repository External Events Hazards Screening Analysis* (BSC 2005 [DIRS 174235], Section 6.4.1). That determination was conservatively based upon limited knowledge of flight data in the area of concern and upon crash data for aircraft of the type flying near Yucca Mountain. The purpose of this report is to identify specific aircraft hazards that may be applicable to a monitored geologic repository (MGR) at Yucca Mountain, using NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants* (NRC 1987 [DIRS 103124], Section 3.5.1.6), as guidance for the inclusion or exclusion of identified aircraft hazards. The intended use of this report is to provide inputs for further screening and analysis of identified aircraft hazards based upon the criteria that apply to Category 1 and Category 2 event sequence analyses as defined in 10 CFR 63.2 [DIRS 176544] (Section 4). The scope of this report includes the evaluation of military, private, and commercial use of airspace in the 100-mile regional setting of the repository at Yucca Mountain with the potential for reducing the regional setting to a more manageable size after consideration of applicable screening criteria (Section 7).

2. QUALITY ASSURANCE

This report is subject to the requirements of QA-DIR-10, *Quality Management Directive* (BSC 2006), because the report determines whether identified aircraft hazards should be considered in subsequent detailed accident analyses that could potentially identify quality-affecting items subject to quality assurance program controls. This report was developed in accordance with PA-PRO-0313, *Technical Reports*.

3. USE OF COMPUTER SOFTWARE AND MODELS

No software requiring qualification per IT-PRO-0011, *Software Management*, has been used in this report. The figures in Section 6 (Figures 6-1 through 6-4) were generated by DeLorme Topo USA® 4.0 (© 2002 – used with permission) and are presented for illustrative purposes only. The DeLorme software is Level 2 software, per IT-PRO-0011, since the figures produced by the software are used for illustrative purposes only. Specific citations are provided for other information on the maps.

4. APPLICABLE CRITERIA AND REQUIREMENTS

Based on frequency of occurrence, event sequences are categorized as Category 1 or Category 2, as described in 10 CFR 63.2 [DIRS 176544]. Category 1 event sequences are “those event sequences that are expected to occur one or more times before permanent closure” (10 CFR 63.2 [DIRS 176544]). Category 2 event sequences are “other event sequences that have at least one chance in 10,000 of occurring before permanent closure” (10 CFR 63.2 [DIRS 176544]). Event sequences that have less than one chance in 10,000 of occurring before permanent closure of the repository are considered beyond Category 2 event sequences and, as such, do not require analyses.

This report does not categorize aircraft hazards. The purpose of this report is to provide inputs for further screening and analysis of the potential aircraft hazards.

5. ASSUMPTIONS

No assumptions were used in this report.

6. AIRSPACE-RELATED FACILITIES, EQUIPMENT, AND ACTIVITIES

Airspaces within 100-miles of the North Portal at Yucca Mountain are described in this section and shown in Figures 6-1 through 6-4. The figures are for illustrative purposes only. Unless stated otherwise, miles are statute miles. A determination of whether these airspace activities are potential credible hazards to the MGR and whether they require further evaluation is made in Section 7.

Several military operations areas (MOAs) and restricted areas surround the MGR at Yucca Mountain. A number of airports and airfields are also located within the regional setting. Military, private, and commercial aircraft accidents have occurred within the 100-mile radius surrounding the MGR at Yucca Mountain. The 100-mile regional setting was selected as a starting point to identify and describe the airspace use surrounding the MGR. It should be noted that the 100-mile regional setting is not intended to infer that airspace-related activities within 100 miles of the site would result in credible hazards to repository surface facilities; rather, the airspace within the 100-mile regional setting of Yucca Mountain is used because a number of airborne activities involving military, private, and commercial aircraft, as well as ordnance, use this airspace. While this report does identify numerous aircraft activity in the 100-mile regional setting, the report is not intended to be all-inclusive to the full 100 miles. The aircraft activity within the screening criteria identified in Section 7 has been identified as being important with respect to analyzing the potential hazard that the activity within the screening criteria may impose on the repository.

Appendix A summarizes civilian and military crashes from 1993 to 2003 in the regional area of the repository. Seventy-seven civilian aircraft accidents involving pilot or passenger fatalities, or both, have occurred in the State of Nevada according to "Aviation Accident Database and Synopses" (Ragan 2004a [DIRS 168113]). Nineteen of the 77 accidents occurred in the regional setting with a majority of those surrounding the Las Vegas area airports (Ragan 2004a [DIRS 168113]). Table A-1 of Appendix A lists the 19 accidents. Eighteen military accidents involving loss of aircraft have occurred within the Nevada Test and Training Range (NTTR) during the 1993 to 2003 timeframe from "FW:Data Query; Yucca Mountain" (McGregor 2004 [DIRS 168121]). Table A-2 of Appendix A lists the 18 military crashes. The aircraft accidents are used to help evaluate aircraft crash hazards at the MGR.

Figure 6-1 illustrates the regional setting with terrain contours. The location of the North Portal (36° 51' 8" north latitude and 116° 25' 35" west longitude) was determined from original survey data (DTN.MO0004YMP00017.000 [DIRS 149831]) and is shown for illustrative purposes only. Figure 6-2 illustrates civilian aviation facilities, civilian airports, instrument flight rules (IFR) for enroute low-and-high altitude airways, and navigation aids in the regional setting. This figure is otherwise identical to Figure 6-1, except that the terrain contour lines are removed for clarity.

Figure 6-3 identifies military and U.S. Department of Energy (DOE) airfields, navigation aids, and military training routes (MTR). Figure 6-4 identifies military accident sites by location. An assigned accident number (corresponding to Appendix A, Table A-2) and the Air Force Safety Center Mishap identification number for each military accident in the NTTR (Appendix A, Table A-2) are included in Figure 6-4 for general information only.

The layout of the NTTR was determined from *Nevada Test and Training Range Chart* (NIMA 2001 [DIRS 158638]). The layout of the R-2508 Complex was determined from *2002 R-2508 Complex User's Handbook* (USAF 2001a [DIRS 158243], Figure 2-3). The location of airports was determined from *Las Vegas Sectional Aeronautical Chart* (NACO 2003a [DIRS 168126]) and NIMA (2001 [DIRS 158638]). Information on military accidents was provided by the Air Force Safety Center at Kirtland Air Force Base in New Mexico (McGregor 2004 [DIRS 168121]).

Aircraft activities are discussed relative to DOE designated airspace, military designated airspace, MTRs and areas, airports, and federal airways and jet routes summarized in Table 6-1 through Table 6-5.

Tables 6-1 and 6-2 identify DOE and military designated airspaces in the vicinity of the MGR North Portal. Table 6-3 identifies MTRs and low altitude training and navigation (LATN) areas and their distance from the MGR North Portal. Table 6-4 identifies civilian and military airports/airfields in the Regional Setting. Table 6-5 identifies Federal Airways (IFR enroute low-and-high altitude routes) and distance from the North Portal.

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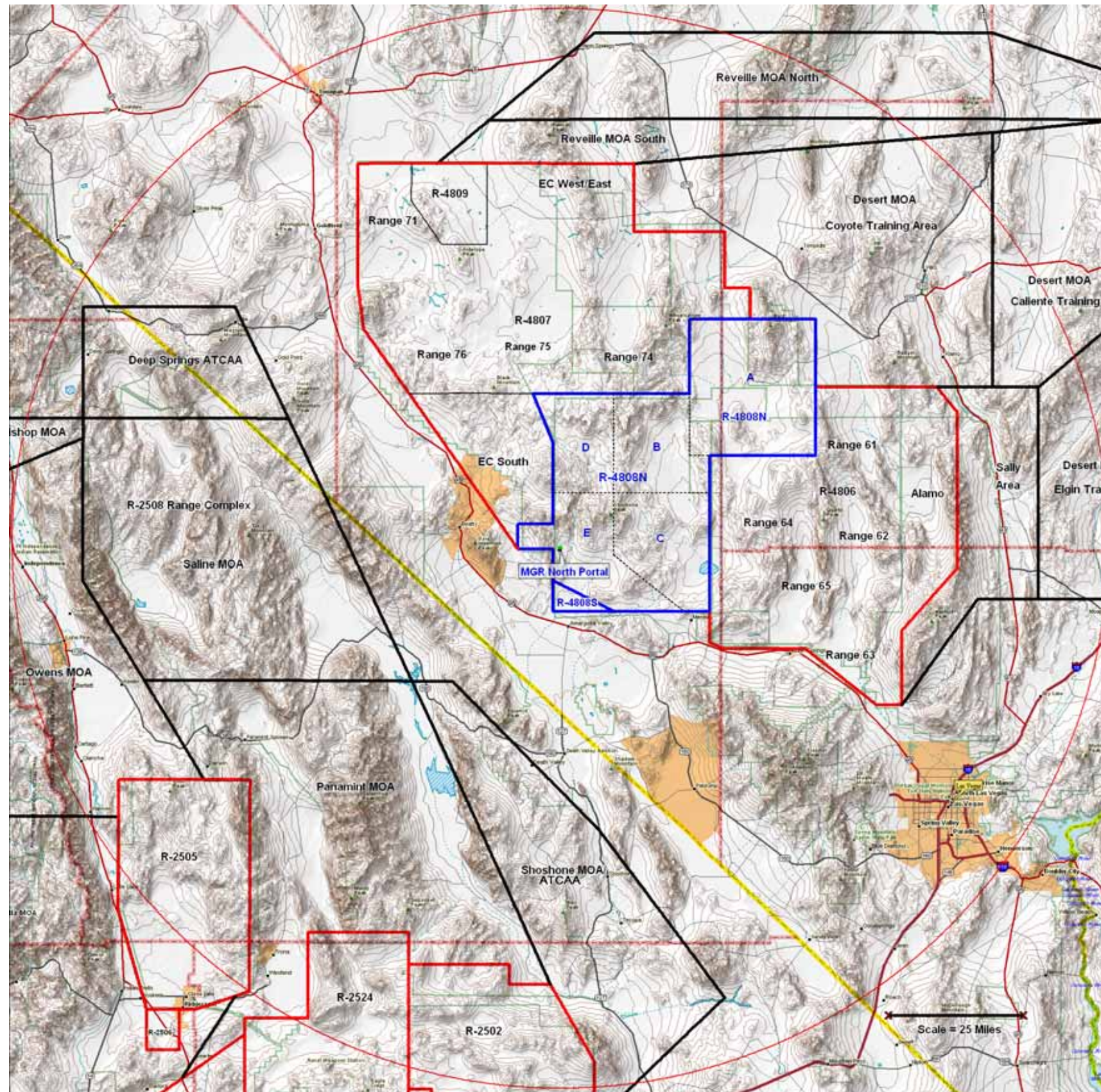
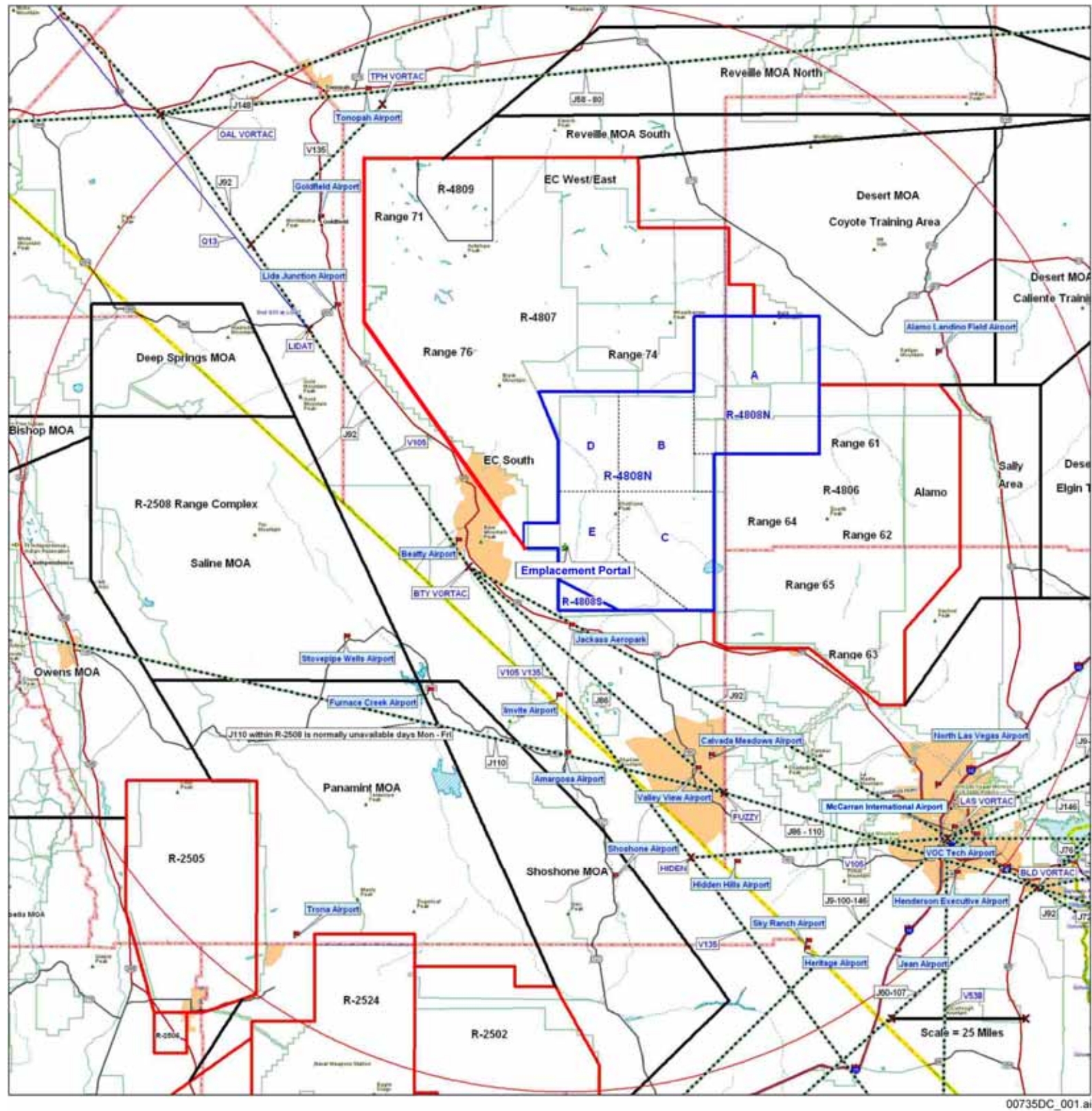


Figure 6-1. Regional Setting Surrounding Yucca Mountain: Includes Military Operations Areas and Military and DOE Restricted Areas

Sources: USAF 2001a [DIRS 158243], Figure 2-3 is used to define the R-2508 military airspace to the west of the Beatty Corridor. USAF 1999 [DIRS 103472], Chapter 1, is used to define the NTTR airspace east of the Beatty Corridor.

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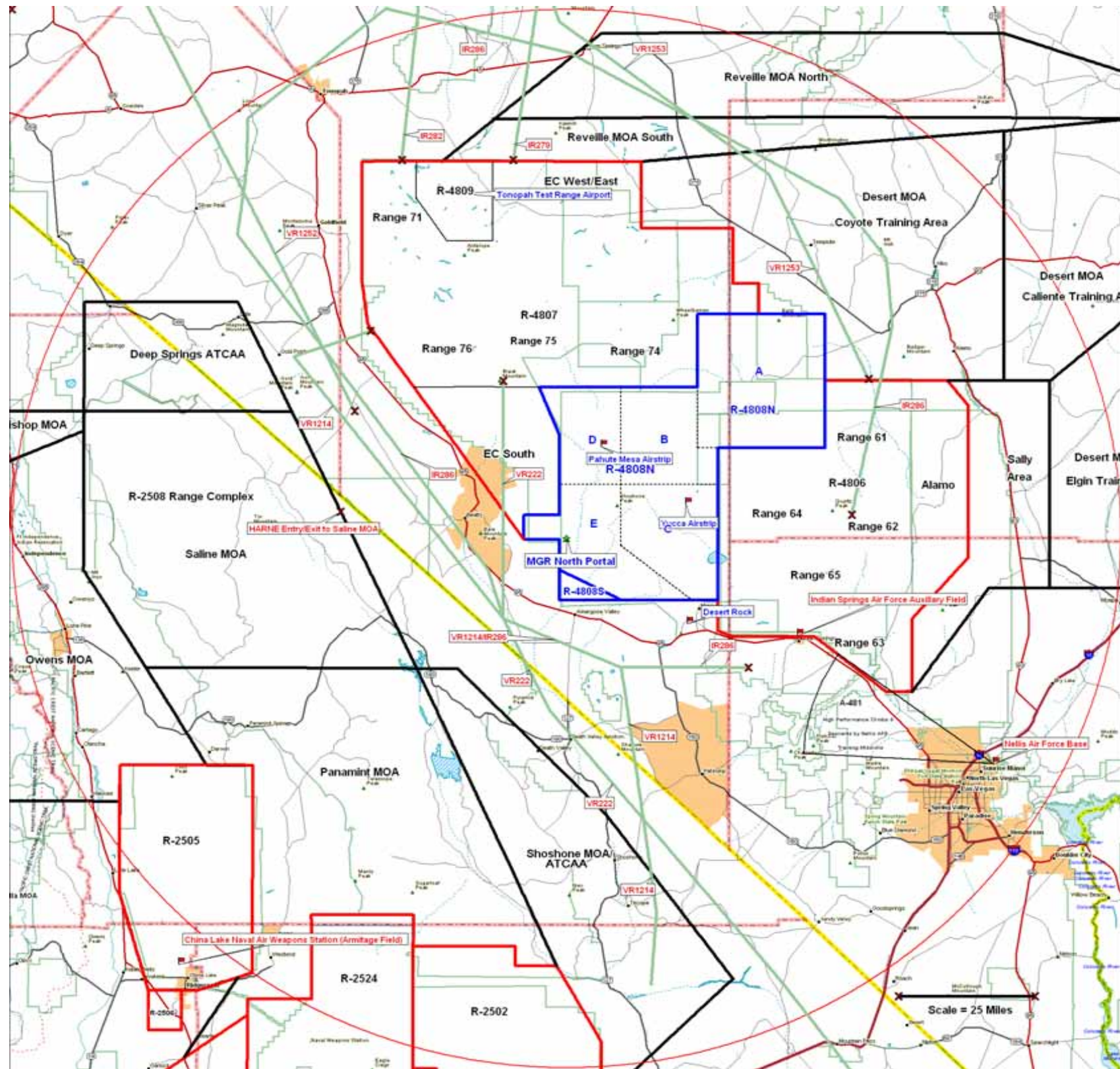


Figure 6-3. Military Airports, Military Training Routes, and Navigation Aids in the Regional Setting

Sources: NIMA 2001 [DIRS 158638] is used to define specific areas in the NTTR. NACO 2003a [DIRS 168126], Figure 2-3 is used to define military airports and military training routes. USAF 2001a [DIRS 158243] is used to define R-2508 airspace west of the Beatty Corridor. USAF 1999 [DIRS 103472], Chapter 1, is used to define NTTR airspace east of the Beatty Corridor

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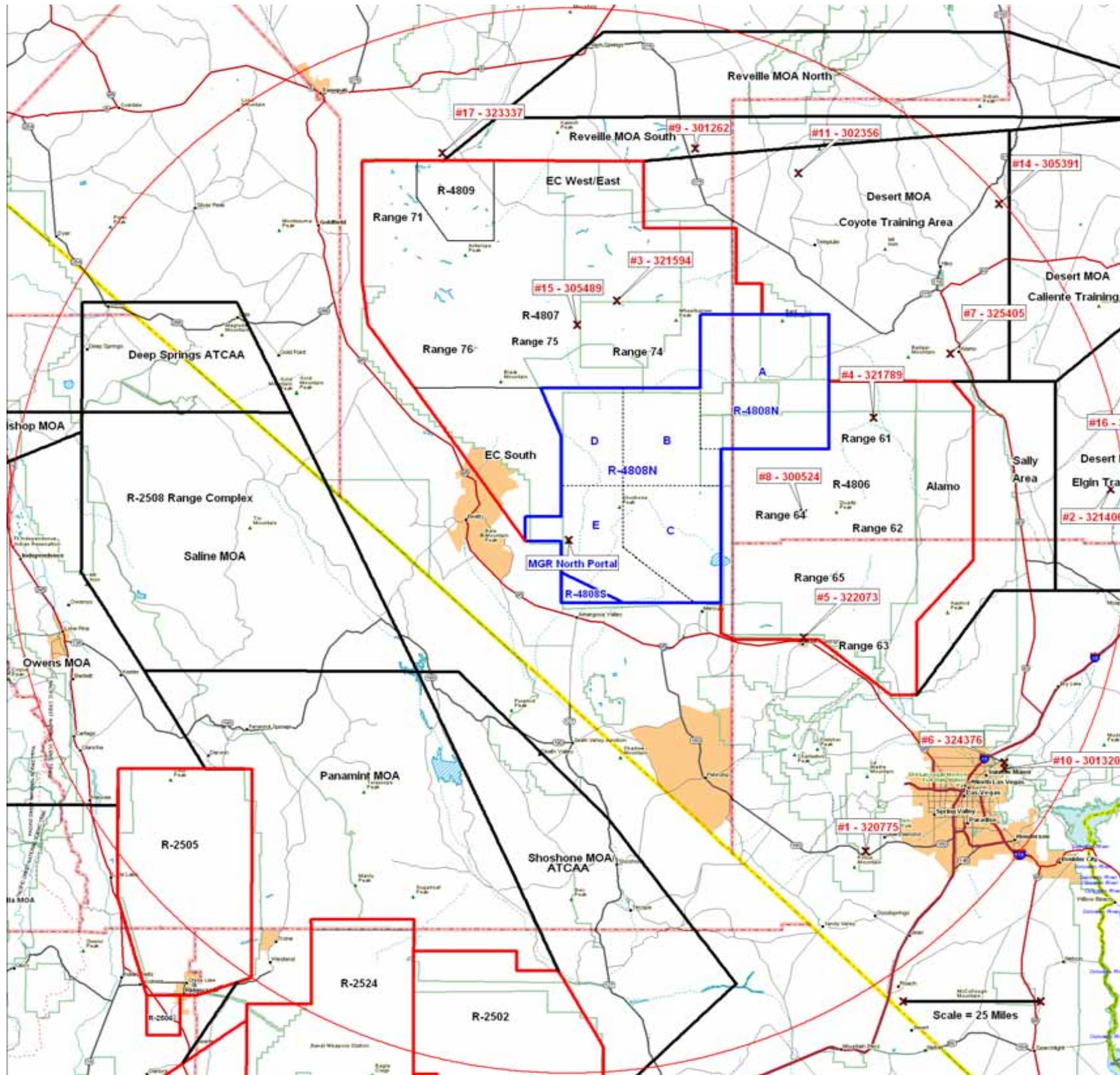


Figure 6-4. Military Aircraft Accidents in the Nevada Test and Training Range
 Sources: McGregor 2004 [DIRS 168121] is used to identify the location of military crashes. USAF 2001a [DIRS 158243], Figure 2-3 is used to define R-2508 airspace west of the Beatty Corridor. USAF 1999 [DIRS 103472], Chapter 1, is used to define NTTR airspace east of the Beatty Corridor.

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Table 6-1. Department of Energy Designated Airspaces

Designated Airspace	Shortest Boundary Distance to North Portal^a (Miles)
R-4808S	6
R-4808N (R-4808A)	29
R-4808N (R-4808B)	13
R-4808N (R-4808C)	7
R-4808N (R-4808D)	10
R-4808N (R-4808E)	Overlays MGR

NOTE: ^a Approximate distances to North Portal were determined from NACO 2003a [DIRS 168126], as measured.

MGR = monitored geologic repository

Table 6-2. Military Designated Airspaces

Designated Airspace	Approximate Closest Distance to North Portal^a (Miles)
NTTR	
Reveille (North and South)	71
Desert	55
North Range	
R-4809	58
R-4807	28
EC South	5
South Range	
R-4806	27

NOTE: ^a Approximate distances to North Portal were determined from NACO 2003a [DIRS 168126], as measured.

EC = electronic combat, NTTR = Nevada Test and Training Range

Table 6-3. Military Training Routes

Military Training Routes	Approximate Closest Distance to North Portal (airway centerline)^a (Miles)
IR-286	15
VR-222	11
VR-1214	18
IR-279	72
IR-282	77
LATN East	101
LATN West	1
LATN Central	46

NOTE: ^aApproximate distances to North Portal were determined from NACO 2003a [DIRS 168126], as measured.

IR = instrument route, LATN = low altitude training navigation, VR = visual route

Table 6-4. Airport Operations

Airport	Approximate Distance to North Portal ^a (Miles)	Operations per Year
Civilian^b		
Alamo	77	230
Amargosa	38	0
Beatty	21	1,005
Calvada Meadows	46	0
Furnace Creek	37	10,200
Goldfield	75	300
Henderson	94	98,500
Heritage	86	0
Hidden Hills	66	200
Imvite	28	0
Jackass Aeropark – Closed as of June 2004	15	604
Jean	97	20,000
Lida Junction	61	10
McCarran International	89	536,300
North Las Vegas	82	198,611
Shoshone	61	700
Sky Ranch	86	3,000
Stovepipe Wells	44	1,000
Tonopah	91	12,727
Trona	87	7,000
Valley View	47	0
VOC Tech	92	0
Military^c		
Nellis Air Force Base	90	32,400
Creech Air Force Base (formally Indian Springs)	45	4,000
Tonopah Test Range	66	200
DOE^d		
Desert Rock	27	4,700
Pahute Mesa	18	0
Yucca Airstrip	20	0

NOTE: ^aApproximate distances to North Portal were determined from NACO 2003a [DIRS 168126], as measured.

^b Civilian airport operations: Ragan 2004b [DIRS 167809].

^c Military operations: Wood 2004 [DIRS 169894].

^d DOE operations: Ragan 2004b [DIRS 167809].

Table 6-5. Federal Airways

Federal Airway	Approximate Closest Distance from Airway Center Line to North Portal (Miles)	Approximate Distance from Airway Edge to North Portal (Miles)	Flights per year
J-9 ^a	86	68	143
J-58/J-80 ^a	82	71	561
J-72 ^a	88	88	3,454
J-76 ^a	88	68	209
J-86 ^a	14	6	3,806
J-92 ^a	11	6	79,753
J-100 ^a	86	68	52
J-110 ^a	41	36 ^b	3,415
J-146 ^a	86	68	65
J-148 ^a	95	71	0
V-105 ^c	16	11	1,017
V-135 ^c	16	11	534
V-244 ^c	85	80	13
V-394 ^c	88	83	196
V-538 ^c	89	83	0
Q13 ^d	61	61	0

NOTE: ^aJet routes (routes that begin with the letter "J") do not have defined widths. Ground controllers continually monitor aircraft flights on jet routes and may divert flights from the centerline as needed to maintain adequate aircraft separation and so as to not intrude in non-authorized/conflicting airspace. Edge distances are measured to the closest restricted airspace location.

^bAssumes a maximum width of this east-west route of 10 miles.

^cVictor route activity (routes that begin with the letter "V") are only associated with instrument flight rules (IFR) flight operations. Visual flight rules (VFR) flights are not reported or known.

^dRoute was not established until November 2003 and terminates at the LIDAT fix. Aircraft at this point join J-92 enroute to southeast locations.

Sources: NACO 2003a [DIRS 168126], for V routes, as measured; NACO 2003b [DIRS 168129], for J routes, as measured; and NACO 2003c [DIRS 168128], for Q Routes, as measured. Flights per year determined from Ragan 2002 [DIRS 160817].

6.1 Nevada Test Site Airspace

The Nevada Test Site (NTS), operated by the DOE as the national on-continent nuclear weapons test site, is protected by restricted areas R-4808N and R-4808S. The NTS airspace R-4808 is controlled by DOE for NTS activities and is not part of the NTTR. Agreements with the U.S. Air Force (USAF) and the Federal Aviation Administration (FAA) allow specific uses by military and civilian aircraft. R-4808N is designated as non-joint use by the FAA and the DOE retains exclusive, continuous control (USAF 1996 [DIRS 157987], Section 1.26.1, and USAF 1999 [DIRS 103472], Section 3.1.1 and Appendix A, Section 2.1). R-4808N is divided into R-4808 East (indicated as R-4808A, R-4808B, and R-4808C on Figures 6-1 through 6-4), and R-4808 West (indicated as R-4808D, and R-4808E on Figures 6-1 through 6-4). R-4808S was created as a joint-use area to permit use by the NTS, Nellis Air Traffic Control Facility, and the

FAA Los Angeles Air Route Traffic Control Center (ARTCC) (USAF 1996 [DIRS 157987], Section 1.26.1).

6.1.1 R-4808S

Restricted Area R-4808S is used jointly by the NTS, Nellis Air Force Base (AFB), and the FAA Los Angeles ARTCC for military and civilian aircraft to overfly the southwest corner on an as-needed basis. Clearance for any aircraft entry into R-4808S is required. The closest boundary of R-4808S to a repository surface facility is about six miles (NIMA 2001 [DIRS 158638]).

6.1.2 R-4808N

Within the R-4808N restricted area, the DOE allows military aircraft to transit R-4808N over R-4808B, R-4808C, R-4808D and R-4808E (Wood 2004 [DIRS 169894], Attachment 6). The repository surface facility site is located in R-4808E. Overflight with live or hung ordnance is prohibited except for critical in-flight emergencies (USAF 1996 [DIRS 157987], Sections 1.26, 1.28, and 1.29). In addition, flight restricted areas exist over the Device Assembly Facility at coordinates 36° 54' 04" north latitude, 116° 02' 51" west longitude and Bren Tower at coordinates 36° 46' 50" north latitude, 116° 14' 33" west longitude (Wood 2004 [DIRS 169894], Attachment 6).

Overflights of R-4808A, which is in R-4808 East, are restricted to United States emergency aircraft and other DOE approved missions (USAF 1996 [DIRS 157987], Sections 1.28).

6.2 Military Airspace

The typical aircraft and their missions that are currently or projected-to-be operational, reported in *Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement* (USAF 1999 [DIRS 103472], pp. 1-45 to 1-50), are discussed in Appendix B. The aircraft, missions, and aircraft configurations described in Appendix B are intended to be representative of ongoing activities in the NTTR.

The restricted areas of the NTTR are divided into the North Range and the South Range. These two ranges are separated by the NTS (USAF 1999 [DIRS 103472], pp. 1-16 to 1-21 and 3.1-3). Ordnance delivery in the NTTR is allowed in some portions of the 60 series ranges in R-4806 of the South Range and some portions of the 70 series ranges in R-4807 of the North Range. Deployment of air-to-ground missiles occurs in the R-4806 (60 Series) and R-4807 (70 Series) ranges as part of the weapons missions of various aircraft. Training exercises using bombs are also conducted in the R-4806 and R-4807 (USAF 2001b [DIRS 158253], Section 4.3.1). Ordnance is not used in the Electronic Combat (EC) South area to the northwest of the North Portal (USAF 1996 [DIRS 157987], Section 1.24.1). See Appendix C for more detail.

Ordnance delivery in the R-2508 complex is only allowed in the restricted areas located near the center or the southern edge of the complex (USAF 2001a [DIRS 158243], Chapter 6), which includes R-2502, R-2505, and R-2524. These areas are located south and west of the Beatty Corridor (NIMA 2001 [DIRS 158638]).

The range operating agency must ensure that weapon safety footprints exist for all aircraft, weapons, and tactics authorized for a given target and event on the range (USAF 2001b [DIRS 158253], Section 4.3.1).

6.2.1 Nevada Test and Training Range

The NTTR includes airspace, land, and infrastructure dedicated to military uses (Figure 6-3) (USAF 1999 [DIRS 103472], Figure 3.1-1, p. 3.1-6). They are composed of the Desert and Reville MOAs and the restricted areas of the NTTR: R-4806, R-4807, and R-4809. Distances to the North Portal are listed in Table 6-2.

Military aircraft reach various MOAs and military designated restricted areas by traveling through the NTS or NTTR restricted areas. The Sally Corridor (part of Desert MOA and immediately east of the 60 Series Ranges) provides the primary access to the MOAs and the military designated restricted areas located north and east of Yucca Mountain.

6.2.1.1 Military Operations Areas

Military airspace includes MOAs and restricted airspace. An MOA is an airspace established to separate or segregate certain military activities from commercial and other civilian air traffic. A restricted area is airspace that is not usually available to civilian aircraft. Restricted airspace may be designated as joint use, whereby non-participating civil or military aircraft may be routed through this airspace by air traffic control when there is no conflict with scheduled activities. If not designated as joint use, non-participating aircraft are normally not permitted at any time.

The Desert (includes Coyote, Sally, Elgin and Caliente areas) and Reville MOAs shown on Figure 6-1 are used for conducting air-to-air intercept training, which consists of high altitude operations, abrupt maneuvers, and supersonic flight at and above 5,000 ft above ground level (AGL). The lowest flight altitude (the base) of each MOA is 100 ft AGL. The ceiling is up to 18,000 ft mean sea level (MSL); however, air traffic control assigned airspace (ATCAA) can be provided on an as-needed basis by the FAA to extend airspace from 18,000 ft MSL to higher altitudes needed to accommodate flight-training requirements (USAF 1999 [DIRS 103472], pp. 3.1-4 and 3.1-5). Appendix C provides greater detail of these areas.

6.2.1.2 Restricted Areas

Restricted areas R-4806 and R-4807 within the NTTR are joint use areas. The adjacent DOE restricted area R-4808S is joint use, but R-4808N and R-4809 are not joint use.

The EC South Range of R-4807 is the closest restricted area to the North Portal. EC South Range is an electronic combat range (ECR) located in the southwest corner of R-4807A. Aircrews are prohibited from dropping any ordnance anywhere within the EC South Range (USAF 1996 [DIRS 157987], Section 1.24.1). The closest boundary of EC South Range to a repository surface facility is listed in Table 6-2 (NIMA 2001 [DIRS 158638]). See Appendix C for more details.

6.2.2 Military Training Routes and Areas

The MTRs and LATNs are listed in Table 6-3. Table 6-3 lists the distances to the North Portal. These include LATN West, LATN Central, LATN East, and MTRs. Appendix C describes these areas and routes in more detail. The LATN West is closest to the North Portal.

The LATN area is an unrestricted airspace established on the sides of the NTTR for A-10s and helicopters to practice a random selection of navigation points and low altitude tactical formations between 100 and 1,500 ft AGL and at speeds below 250 knots (USAF 1999 [DIRS 103472], pp. 3.1-5 to 3.1-8). This area is normally used when no airspace is available for this type of training within the NTTR complex. LATN East is outside the 100-mile regional setting.

MTRs permit military flight training at airspeeds in excess of 250 knots below 10,000 ft MSL while providing training in low altitude tactics and navigation (USAF 1999 [DIRS 103472], pp. 3.1-5 to 3.1-8). There are approximately 21 different MTRs within or immediately adjacent to the NTTR, five MTRs exist within NTTR restricted airspace (Table 6-3). Routes IR-286 and VR-222 are closest to the North Portal. Descriptions of MTRs are provided in Appendix C (USAF 1999 [DIRS 103472], pp. 3.1-5 to 3.1-8).

Two refueling areas, AR-231V and AR-625, are within the 100-mile regional setting, (USAF 2005 [DIRS 176948], Section 4.10).

AR-231V is located to the southwest of the North Portal in Death Valley and approximately 47 miles to the Air Refueling Initial Point. This refueling route is used to refuel HH-60 helicopters using C-130 aircraft. Altitude for this refueling route is defined as below FL180 (flight level below 18,000 ft).

AR-625 is used to refuel aircraft. It has two altitudes for aircraft refueling. The low track is FL180 to FL210 and the high track is from FL230 to FL250 (USAF 2005 [DIRS 176948], Section 4.10). The closest point to the North Portal is approximately 69 miles (NACO 2003a [DIRS 168126], as measured).

6.2.3 R-2508 Complex

A large area of airspace, referred to as the R-2508 Complex, exists to the west of Yucca Mountain and is composed of MOAs and restricted areas. The R-2508 Complex includes the airspace and associated land presently used and managed by Edwards AFB, National Training Center, Fort Irwin, and Naval Air Warfare Center Weapons Division, China Lake (USAF 2001a [DIRS 158243], Section 2.3). The distances to the North Portal are listed in Table 6-2. Aircraft from the R-2508 Complex access the restricted areas in the NTTR by the same access routes used by the aircraft from Nellis AFB.

6.3 Civilian, Federal, and Military Airports

A number of airports or airfields are located within the regional setting of Yucca Mountain (Figure 6-2 and Figure 6-3). These include civilian, military, and DOE airports (Table 6-4). Appendix D describes civilian, military, and DOE airports and airfields within a 100-mile radius of the North Portal. Existing facilities range from small, private landing strips to a major

international airport. Aircraft activity ranges from 0 to 0.5 million operations per year. High-volume facilities are located southeast of Yucca Mountain near Las Vegas.

There are 22 civilian airports within the 100-mile radius of the North Portal. Jackass Aeropark is the closest civilian airport to the North Portal, while McCarran International and North Las Vegas airports have the most operations per year. The Jackass Aeropark, located in Amargosa Valley, is a public facility owned by the U.S. Bureau of Land Management. The facility has been closed and the FAA has deemed that it be returned to a natural state. McCarran International Airport, located in Las Vegas, Nevada, and North Las Vegas Airport, located in North Las Vegas, Nevada, are public facilities owned by Clark County, Nevada.

There are three military airports within 100 miles of the North Portal. A description of these airports is given in Appendix D. Creech Air Force Base (formally Indian Springs) is the closest military airport to the North Portal; while Nellis Air Force Base has the most operations per year and Tonopah has the least operations per year. Distance from the North Portal and operations per year are listed in Table 6-4. Creech Air Force Base is located on the southern boundary of R-4806. Nellis AFB is surrounded by the Las Vegas airspace. An advisory area, A-481, is located to the west of Nellis AFB and is used for high-performance climbs and descents to or from Nellis AFB (NACO 2003a [DIRS 168126]).

Small commuter aircraft that fly staff and equipment to and from various national laboratories and the NTS use the Desert Rock Airport. Helicopters based on the NTS also use this airfield. Pahute Mesa Airstrip is currently used very infrequently. The Yucca Airstrip is unpaved and has not been used since 1995 (Langendorf 2002 [DIRS 158247]).

Helicopter operations are conducted from helipads at Mercury, Area 6, Area 29, Area 12, and the Field Operations Office in Area 25, as well as Desert Rock Airfield and Pahute Mesa (Langendorf 2002 [DIRS 158247]). Most of the helicopter traffic to these areas is out of the Desert Rock Airport.

6.4 Instrument Flight Rules Enroute Low and High Altitude Routes and “Q” Routes

IFR enroute low altitude routes are established below 18,000 ft MSL and are normally used by non-pressurized propeller aircraft or aircraft not equipped for long-distance, high-altitude flight. Low-altitude IFR routes are designated with the letter “V” and two to three numerical digits and are referred to as Victor routes.

Generally overlying the federal airways bordering the NTTR are high altitude routes on which the greatest majority of IFR air traffic conducts flight at or above 18,000 ft MSL. These routes are depicted on charts with the letter “J”, followed by two to three numerical digits and are referred to as Jet routes. Typical aircraft flying these routes include airliners, air cargo, corporate jets, and other high-performance aircraft including military aircraft.

Jet routes and Victor routes are flown using ground-based radio navigation facilities; Very High Frequency Omnidirectional Range (VOR) or Very High Frequency Omnidirectional Range collocated with Tactical Aircraft Control and Navigational (VORTAC). Aircraft fly either to or from these directional radio beacons. Area Navigation or “Q” routes were introduced in late 2003. One Q-route is in the vicinity of the North Portal. These routes are designed for high-altitude aircraft, typically using global positioning system navigational aids, flying point-to-

point. Route Q13 terminates at the LIDAT navigation fix approximately 61 miles northwest of the North Portal.

Figure 6-2 depicts the civilian air traffic routes, including the Victor routes and Jet routes that border the NTTR/NTS. Table 6-5 lists the federal airways and jet routes in the regional setting of Yucca Mountain and distances from the North Portal (NACO 2003a [DIRS 168126], NACO 2003b [DIRS 168129], NACO 2003c [DIRS 168128]). Victor airways and Jet routes that are near Yucca Mountain are discussed in Appendix E. V-105 and V-135 are the closest airways and J-86 and J-92 are the closest Jet routes to Yucca Mountain (Table 6-5).

J-86 terminates at the BTY VORTAC to the north and joins J-110 at the FUZZY navigation fix to the southeast to the BLD VORTAC, where it joins the J-72 route (Figure 6-2).

J-92 intersects the OAL VORTAC to the north and the BLD VORTAC to the south and continues southeast (Figure 6-2).

The V-105/135 airway passes to the west of the NTS. V-105 continues to the OAL VORTAC and then on to Reno, Nevada. Low altitude route V-135 heads northeast at the TEZUM fix and terminates at the Tonopah Airport.

6.5 Ground-To-Ground Missile Testing at Nevada Test Site

The last army tactical missile system launch was conducted at the NTS in R-4808A Area 26 in June 2000 (Childers 2002 [DIRS 158246]). There are no forecasts for future ground-to-ground missile testing (Childers 2002 [DIRS 158246]) and, therefore, ground-to-ground missile testing is not evaluated further.

6.6 Ordnance

Inert and live ordnance are used in allowed ranges (Appendix C). Ordnance includes air-to-ground ordnance, such as general purpose bombs, cluster bombs and guided bombs; air-to-ground missiles and rockets, including cruise missiles; and general ammunitions (USAF 1999 [DIRS 103472], pp. 1-50 to 1-51). Due to safety concerns, the NTTR does not support the actual launching of air-to-air missiles (USAF 1999 [DIRS 103472], p. 1-52). Cruise missiles are launched from bombers and testing consists of cruise missile flight tests (USAF 1999 [DIRS 103472], pp. 1-42, 1-46, and 1-51).

6.7 Dropped Objects

Dropped objects from aircraft occur infrequently. When maintenance crews determine that a part from the aircraft is missing, it is reported as a dropped object after the fact. Most items are relatively small parts normally classified as screws, antenna, pins, housing covers, light lens, cables, etc. (Wood 2004 [DIRS 169894], Attachment 2). In many instances the location of the dropped object is unknown. In a few instances the pilot will be aware of a dropped object due to a change in flight characteristics and a general location might be determined.

Between 1998 and 2003 an average of 36 dropped objects per year has been reported (Wood 2004 [DIRS 169894], Attachment 2).

6.8 Electronic Combat and Jamming

Electronic combat, including electronic jamming activities known as Electronic Counter Measures, takes place in the designated Electronic Combat areas (USAF 1996 [DIRS 157987], Sections 1.19 through 1.24). Radar jamming against threat signals and communications jamming can take place during transit of the EC ranges within the spectrum clearances provided by the 99th Communications Squadron (USAF 1996 [DIRS 157987], Section 3.4.7.1).

To provide training realism, threat simulation electronic emitters (radars) are located throughout the EC ranges. The majority of this equipment is aircraft threat simulation radar. Frequency management ensures that these transmitters do not create interference with other federal or civil transmitters or receivers. The unit is normally placed on elevated ground, and then emits skyward. It is not pointed at the ground, or along roadways (USAF 1999 [DIRS 103472], Section 3.3.1). The safe separation distances between the emitters and people or other equipment are provided in feet with the greatest distance given as 783 feet. (USAF 1999 [DIRS 103472], Table 3.3-1). Radio frequency emitters (radar jamming) used on aircraft pose no hazard to the public due to the aircraft's altitude, the energy levels used by the equipment, and the speed of the aircraft (USAF 1999 [DIRS 103472], Section 3.3.1). Radio frequency emissions near the NTS are coordinated with the DOE, because there are communication and other electronic equipment at the NTS that is sensitive to radio frequency emissions (USAF 1999 [DIRS 103472], p. 3.3-3). Thus radio frequency emissions are coordinated through the appropriate Spectrum Management Office to facilitate testing and training (USAF 2001b [DIRS 158253], Section 5.3).

6.9 Limited Characterization of Visual Flight Rules Flight in the Beatty Corridor

General aviation flights in the Beatty Corridor are not typically tracked by radar and, thus, detailed knowledge of these flights is limited. A survey trip was conducted to characterize the general aviation flights and information from that trip is discussed in the following paragraphs (Gorski 2004 [DIRS 170589]).

Visual Flight Rules (VFR) flights in the Beatty Corridor can be characterized as relatively light compared to other areas of the country due to the very low population in the area and a significantly fewer number of aircraft registered in the area per square mile. The closest operational airport to the North Portal is the Beatty Airport. The number of aircraft at the Beatty Airport is low and in observations over two days in late April 2004 (Gorski 2004 [DIRS 170589]), no aircraft activity was seen in the Beatty Corridor. In two days of travel from Tonopah to Pahrump only two single-engine aircraft were seen operating. One aircraft departed Calvada Meadows heading to the west and another aircraft was seen departing Tonopah heading south and then west. During the same trip, a highway construction worker on US 95 just north of Lida Junction was interviewed and questioned as to air traffic in the area. The worker indicated that no small aircraft were seen in the area in the past three weeks while he was manning a highway construction stop sign. The worker did witness one helicopter in the area to the west of US 95 in that timeframe but could not determine if it was civilian or military (Gorski 2004 [DIRS 170589]).

The airport manager at Jackass Aeropark characterized VFR flight operations as low. At this time, he indicated that the airport was to be shut down June 30, 2004. The facility is owned by

the Bureau of Land Management and leased to the aircraft owners. The runway is in poor condition and airport manager indicated that prop damage from loose asphalt made the use of the airport subject to aircraft caution. He also indicated that the pilots do not fly to the east of highway US 95 due to military operations (Gorski 2004 [DIRS 170589]).

Articles in the local papers indicated that the county was considering buying the airport and repairing the runway. Nevertheless, on June 25, 2004, the Pahrump Valley Times reported that Nye County commissioners had rejected plans to acquire the airport. As stated in Section 6.3, the Jackass Aeropark has shut down.

The Beatty Airport is not manned. A local aircraft owner was interviewed and was asked to characterize the VFR aircraft traffic in the Beatty Corridor. The owner indicated that there were extensive aircraft operations in the area, in spite of the two days with no activity witnessed. The Beatty Airport has three gliders and they sail to the west of the airport over a mountain that is 6,317 ft high with the surrounding valley at about 3,200 ft above sea level. No glider traffic was witnessed in the area. The owner indicated that he does not file flight plans when navigating the Beatty Corridor and instead would use flight following services during poor weather, if he felt it necessary. Flight following service is offered on an as available service by the FAA to help VFR pilots navigate (Gorski 2004 [DIRS 170589]).

An analysis of the flights in the Beatty Corridor indicates that approximately 16% of all flights are from general aviation; however, it should be noted that these aircraft are flying IFR and there is no accurate count of VFR flights (Gorski 2004 [DIRS 170589]).

A natural barrier to general aviation flights is the mountainous terrain to the immediate east of US 95 and somewhat further to the west. VFR pilots avoid flights over or near the mountains due to greater turbulence and prefer to remain in the valley areas, especially should a forced landing be required. While a light aircraft can glide great distances under pilot control, pilots in control of their aircraft would immediately glide toward valley locations. The north-south valley in the Beatty Corridor makes an ideal flight path for VFR flight with many bright sunny days. The area is easy to navigate due to prominent land features resulting in a potentially lower number of documented flights (fewer flight plans filed at the Reno Center). Records of flight plans are not maintained by the FAA, so documented evidence of flights is not available.

7. HAZARD SCREENING

A description of airspace-related activities and their associated facilities and equipment within the regional setting extending approximately 100 miles from the North Portal is presented in Section 6. These activities are evaluated in Section 7 to determine their potential hazard to the MGR.

The process for identifying aircraft hazards that require additional evaluation is to evaluate the potential hazard using conservative criteria based upon distance from: airports, MTRs, Federal airways, and designated airspace. The hazards that can be clearly shown to pose negligible risk to the MGR due to these factors are screened from further quantitative evaluation. The screening evaluations are performed in Section 7.2.

7.1 Screening Criteria

The following criteria have been selected to screen out activities that pose negligible hazards to a surface facility at Yucca Mountain.

7.1.1 Distance from Civilian and DOE Airports

Criterion: Civilian airports with aircraft more than 20 miles from the North Portal do not pose a hazard to that facility.

Basis: Transition from cruise configuration to landing configuration or from take-off configuration to cruise configuration generally occurs within 5 miles of the airport. That is, the aircraft has raised/lowered the landing gear, the flaps are fully withdrawn/extended, and the aircraft has reached airspeed such that the throttle can be reduced in support of noise abatement requirements/normal landing speed. In addition, within the 5 miles, the pilot is in contact with ARTCC/control tower. DOE-STD-3014-96 (DOE 1996 [DIRS 101810], Tables B-2 to B-5) reports crash probabilities per square mile for airports with civilian traffic out to 16 miles from the airport. Crash probabilities per square mile due to civilian airport activity are considered negligible outside this distance (DOE 1996 [DIRS 101810], Section B.3.3). The criterion of 20 miles provides an additional conservative margin for screening from consideration those aircraft disabled while taking-off or landing at nearby airports.

7.1.2 Distance from Military Airports

Criterion: Military airports more than 25 miles from the North Portal do not pose a hazard to that facility.

Basis: The maximum distance from an airport with military aircraft, where crash probabilities per square mile are reported, is 22 miles (DOE 1996 [DIRS 101810], Tables B-6 to B-13). Crash frequencies due to military airport activity are considered negligible outside this distance from the airport (DOE 1996 [DIRS 101810], Section B.3.3). The criterion of 25 miles provides a conservative margin for screening from consideration those aircraft disabled while taking-off or landing at nearby airports.

7.1.3 Distance from Federal, Military, and DOE Designated Airways

Criterion: Federal, military, and DOE designated airways more than 30 miles from the North Portal do not pose a hazard to that facility.

Basis: Screening criterion II.1(c) of NUREG-0800 (NRC 1987 [DIRS 103124], Section 3.5.1.6) indicates that a federal airway, holding pattern, or approach pattern at least 2 miles beyond the site presents an acceptably low risk. NUREG-0800 is used for review of light water reactor nuclear power plants. Although screening criteria established for nuclear power plants are not directly applicable for use at the MGR, the potential hazards associated with aircraft are similar. Therefore, NUREG-0800 is being used as a basis for establishing screening criteria to be used for evaluating aircraft hazards at the MGR.

A criterion of 30 miles from the closest edge of the airway, which provides margin to the NUREG-0800 (NRC 1987 [DIRS 103124], Section 3.5.1.6) screening criterion, was selected for

conservatism. It can be concluded that selecting a criterion zone that extends 30 miles from the North Portal will ensure that any airways screened out will have no impact on the cumulative crash probability.

7.1.4 Distance from Airports

Criterion: If ten times the annual number of operations at an airport is less than $1000 \times D^2$, where D is the distance in miles from the MGR, operations at the airport do not pose a hazard to the facility.

Basis: Screening criterion II.1(a) of NUREG-0800, (NRC 1987 [DIRS 103124], Section 3.5.1.6) indicates that an airport located a distance D of more than 10 miles from a site presents an acceptably low risk if the annual number of operations at the airport is less than $1000 \times D^2$, where D is distance in miles. For example, at a distance of 10 miles, the annual operations must be less than 100,000. As stated in Section 7.1.3, the use of NUREG-0800 screening criteria is being used as a basis for establishing screening criteria for use with the MGR.

7.2 Screening Evaluations

The airspace activities are evaluated within the 100-mile regional setting. Rationale for screening those activities with acceptably low probability of impact to the MGR is provided in the following paragraphs.

7.2.1 DOE and Military Designated Airspace

The North Portal is located in the R-4808E DOE designated airspace (Table 6-1 and Figure 6-1). Restricted areas R-4808B, R-4808C, and R-4808D have common boundaries with R-4808E. The entire R-4808N area (R-4808A, B, C, D, and E) is within the 30-mile screening criterion (Section 7.1.3) and, therefore is identified as requiring further evaluation.

R-4808E has a common boundary with the EC South area of R-4807 (Table 6-2). Those flights from EC South, entering and leaving R-4808E are captured in the flights near the North Portal. The western portion of R-4806 is also within the 30-mile screening criteria and is identified as requiring further evaluation. The rest of the military designated airspaces in the NTTR and China Lake are located at distances greater than the 30-mile screening criterion (Section 7.1.3) and are screened from further analysis.

As discussed in Section 6.1, R-4808N airspace is controlled by DOE for NTS activities and is not part of the NTTR. The DOE allows military aircraft to transit R-4808N over R-4808B, R-4808C, R-4808D and R-4808E. No ordnance delivery is allowed. However, carrying ordnance is not prohibited, therefore, dropped ordnance should be evaluated.

The North Portal is approximately 27 miles from the western border of R-4806 (Table 6-2). As discussed in Section C.2.2.2 of Appendix C, the western section of R-4806 contains the 60 Series Ranges that are used for conventional bombing and gunnery testing and training. Range 64 of the 60 Series Ranges is the closest to the North Portal. It is further subdivided into R-64A, R-64B, R-64C and R-64D. Ranges 64A and 64 D are used primarily as training for helicopter operations and transition areas for aircraft going into Range 65. No ordnance is authorized in R-64A.

There have been no reports of aircraft delivering ordnance that have impacted outside the NTTR, or of any flight-related mishaps involving ordnance delivered outside the NTTR and inside the NTS during the period of 1993 through 2003. All ordnance impacts were within the designated surface hazard area (Wood 2004 [DIRS 169894], p. 1). Therefore, stray ordnance, deployed but strayed off target, is not considered a hazard requiring further evaluation.

In summary, the entire R-4808N area (R-4808A, B, C, D, and E), the EC South area of R-4807, and the western portion of R-4806 have been identified as needing further evaluation for aircraft hazards. Dropped ordnance from transient flights over R-4808N has also been identified as needing further evaluation.

7.2.2 Military Training Routes and Areas

Military training routes IR-286, VR-1214, VR-222, and LATN West are adjacent to R-4808E. These routes and training areas are within the 30-mile screening criterion (Section 7.1.3).

Military flights below 10,000 ft MSL are conducted on military training routes VR-222, VR-1214, and IR-286. Due to the topographic features in the area and the altitude limitations of the MTRs, military training routes VR-222, VR-1214, and IR-286 are screened from further analysis because military flights below 10,000 ft do not pose a hazard to the MGR (Appendix F).

The rest of the training routes and LATN (Central and East) areas are at a greater distance than the 30-mile screening criterion (Table 6-3 and Section 7.1.3) and are screened from further analysis.

LATN West is located approximately 1 mile from the North Portal (Table 6-3). Military aircraft flying in LATN West are included in the airspace influencing the aircraft hazards at the MGR facilities identified in Section 7.2.1.

7.2.3 Civilian and DOE Airports/Helipads

Jackass Aeropark is the only general aviation airport listed in Table 6-4 that is located within 20 miles from the North Portal. Jackass Aeropark was closed as of June 2004 and is not included as an airport with aircraft hazards for the MGR. The rest of the civilian airports are located more than 20 miles from the North Portal and are screened from further analysis based on screening criterion 7.1.1.

The DOE Desert Rock airport is not located within 20 miles of the North Portal and is screened from further analysis based on screening criterion 7.1.1.

Although civilian and DOE airports have been screened from further analysis, based on screening criterion 7.1.1, the distance and annual operations are compared with screening criterion 7.1.4, as additional confirmation.

Screening criterion 7.1.4 references NUREG-0800 (NRC 1987 [DIRS 103124], Section 3.5.1.6), which specifies that an airport located a distance D of more than 10 miles from a site presents an acceptably low risk if the annual number of operations at the airport is less than $1,000 \times D^2$. For additional conservatism, ten times the annual number of operations is compared to the criterion of $1,000 \times D^2$. Table 7-1 duplicates the information in Table 6-4 for civilian and DOE airports.

Column 3 of Table 7-1 shows the NUREG-0800 criterion of $1,000 \times D^2$. Column 4, the annual operations at the airport, is well within the criterion for an acceptably low risk (Column 3). Likewise, Column 5, ten times the annual operations, is also within the criterion (Column 3). Therefore, civilian and DOE airports do not require additional evaluation based on screening criteria 7.1.1 and 7.1.4.

The DOE Area 29 Helipad and Field Operations Office Helipad are both located within the 20-mile screening criterion for civilian airports. Piston engine aircraft and helicopters are included in the airspace influencing the aircraft hazards to the MGR facilities and, therefore, require further evaluation.

Table 7-1. Civilian and DOE Airport Screening

Airport	Approximate Distance to North Portal^a (Miles)	NUREG-0800 Criteria (1000 x D²)	Operations per Year	Screening Criteria 7.1.4 (10 x Operations/yr)
Civilian^b				
Alamo	77	5,929,000	230	2,300
Amargosa	38	1,444,000	0	0
Beatty	21	441,000	1,005	10,050
Calvada Meadows	46	2,116,000	0	0
Furnace Creek	37	1,369,000	10,200	102,000
Goldfield	75	5,625,000	300	3,000
Henderson	94	8,836,000	98,500	985,000
Heritage	86	7,396,000	0	0
Hidden Hills	66	4,356,000	200	2,000
Imvite	28	784,000	0	0
Jackass Aeropark	15	225,000	604 (Closed June 2004)	6,040 (Closed June 2004)
Jean	97	9,409,000	20,000	200,000
Lida Junction	61	3,721,000	10	100
McCarran International	89	7,921,000	536,300	5,363,000
North Las Vegas	82	6,724,000	198,611	1,986,110
Shoshone	61	3,721,000	700	7,000
Sky Ranch	86	7,396,000	3,000	30,000
Stovepipe Wells	44	1,936,000	1,000	10,000
Tonopah	91	8,281,000	12,727	127,270
Trona	87	7,569,000	7,000	70,000
Valley View	47	2,209,000	0	0
VOC Tech	92	8,464,000	0	0
DOE^c				
Desert Rock	27	729,000	4,700	47,000
Pahute Mesa	18	324,000	0	0
Yucca Airstrip	20	400,000	0	0

NOTES: ^aApproximate distances to North Portal were determined from NACO 2003a [DIRS 168126], as measured.

^bSee Table 6-4 for operations per year for civilian airports.

^cSee Table 6-4 for operations per year for DOE airports.

7.2.4 Military Airports

The three military airports listed in Table 6-4 are located at a distance from the North Portal greater than the 25-mile screening criterion 7.1.2. The three military airports, therefore, are not included as aircraft hazards for the MGR.

Although military airports have been screened from further analysis based on screening criterion 7.1.2, the distance and annual operations are also compared with screening criterion 7.1.4, as additional confirmation.

Screening criterion 7.1.4 references NUREG-0800 (NRC 1987 [DIRS 103124], Section 3.5.1.6), which specifies that an airport located a distance D of more than 10 miles from a site presents an acceptably low risk if the annual number of operations at the airport is less than $1,000 \times D^2$. For additional conservatism, ten times the annual number of operations is compared to the criterion of $1,000 \times D^2$. Table 7-2 duplicated the information in Table 6-4 for military airports. Column 3 of Table 7-2 shows the NUREG-0800 criterion of $1,000 \times D^2$. Column 4, the annual operations at the airport, is well within criterion for an acceptably low risk (Column 3). Likewise, Column 5, ten times the annual operations, is also within the criterion (Column 3). Therefore, military airports do not require additional evaluation based on screening criteria 7.1.2 and 7.1.4.

Table 7-2. Military Airport Screening

Military Airport	Approximate Distance to North Portal ^a (Miles)	NUREG-0800 Criteria ($1000 \times D^2$)	Operations per Year ^b	Screening Criteria 7.1.4 ($10 \times$ Operations/yr)
Nellis AFB	90 miles	8,100,000	32,400	324,000
Creech AFB	45 miles	2,025,000	4,000	40,000
Tonopah	66 miles	4,356,000	200	2,000

NOTES: ^aApproximate distances to North Portal were determined from NACO 2003a [DIRS 168126].

^bOperations per Year from Wood 2004 [DIRS 169894], Table 6-4.

7.2.5 Federal Airways and Jet Routes

From Table 6-5, the federal airways and jet routes that are outside the 30-mile screening criterion 7.1.3 are screened from further analysis as hazards to the MGR. J-86, J-92, V-105, and V-135 are less than 30 miles from the MGR and, therefore, are included as potential aircraft hazards to the MGR.

For the purpose of this report, R-4808S is considered less than the 30-mile screening criterion and is included as a potential aircraft hazard to the MGR.

7.2.6 Military Refueling Routes

Refueling routes AR-625 and AR-231V (Section 6.2.2) are at a greater distance than any of the distances established in the criteria used to screen air traffic. In addition, significant terrain obstacles are present, such that a hazard to the North Portal does not require further consideration. Due to the distance between the military refueling routes and the North Portal (greater than 30 miles), the refueling routes are screened from further consideration per screening criterion 7.1.3.

7.2.7 Flights in the Beatty Corridor Uncontrolled Airspace

Uncontrolled airspace (also known as ‘class G’ airspace) exists close to the ground where radar coverage is not normally possible. Air traffic control does not exercise any authority in uncontrolled airspace.

Flights in uncontrolled airspace in the Beatty Corridor are difficult to characterize in terms of number of flights (Section 6.9). Flights in uncontrolled airspace in the Beatty Corridor are included as potential hazards to the MGR.

7.2.8 Electronic Counter Measures

Electronic counter measures are discussed in Section 6.8. As stated in Section 6.8, electronic counter measures are performed on the EC ranges using the preauthorized electronic spectrum. Although flights in the EC South range have been identified for further analysis (Section 7.2.1), electronic jamming is not considered a credible threat to the repository facilities or equipment due to its distance from the facility and the controls established by the Air Force on identifying the authorized electronic spectrum. As a defense in depth measure, it is recommended that electronic jamming activities not occur while aircraft fly over the Yucca Mountain facilities and that radio frequency spectrum used at the Yucca Mountain site be coordinated through the appropriate Spectrum Management Office. As such, the stated recommendation has been identified in the conclusions as requiring further analysis.

8. CONCLUSIONS

Airspace-related activities within the regional setting of the North Portal are described in Section 6. A large regional setting (i.e., 100-mile radius) was selected to describe the numerous military and commercial airspace activities surrounding Yucca Mountain. This area includes: two major military test and training ranges; the NTS; several military, DOE, and commercial airports; and various civilian and military airways and flight corridors. Although the setting is larger than normally considered for NUREG-0800 evaluations (NRC 1987 [DIRS 103124], Section 3.5.1.6), this report nevertheless provides a comprehensive description of the large military range complex existing within the regional setting. Screening criteria based on airport crash tables in DOE-STD-3014-96 (DOE 1996 [DIRS 101810], Section B.3.3) and crash distance criteria were developed. Based on the evaluation, it is concluded that airspace activities within these various flight corridors, located outside of the screening criteria, do not pose a credible hazard to the MGR.

Airspace activities were evaluated within this regional setting with the screening criteria outlined in Section 7. Airspace activities not screened out in Section 7 are considered potential aircraft hazards and require crash frequency determination and summation to determine the total frequency of aircraft hazards. Aircraft and airspaces that can pose a potential hazard to the MGR, and that have been identified for further analysis, are listed Table 8-1. Inadvertent dropped ordnance has also been identified for further analysis. As a defense-in-depth measure, it is recommended that electronic jamming activities not occur while aircraft fly over the Yucca Mountain facilities and that radio frequency spectrum used at the Yucca Mountain site be coordinated through the appropriate Spectrum Management Office.

Table 8-1. Aircraft/Airspaces Posing a Potential Hazard to the Monitored Geologic Repository Identified for Further Analysis

Type of Airspace/Airport	Aircraft	Reference Section
DOE Designated Airspace		
R-4808A	Small attack/fighter military aircraft	7.2.1
R-4808B	Small attack/fighter military aircraft	7.2.1
R-4808C	Small attack/fighter military aircraft	7.2.1
R-4808D	Small attack/fighter military aircraft	7.2.1
R-4808E	Small attack/fighter military aircraft	7.2.1
Military Designated Airspace		
EC South area of R-4807 and western portion of R-4806	Small attack/fighter military aircraft	7.2.1
Civilian and DOE Airports		
DOE Area Pad 29	Helicopters	7.2.3
Field Operations Office Helipad	Helicopters	7.2.3
Federal Airways and Jet Routes (includes R-4808S)		
J-86	Military, commercial and general aviation aircraft	7.2.5
J-92	Military, commercial and general aviation aircraft	7.2.5
V-105	Military and civilian aircraft	7.2.5
V-135	Military and civilian aircraft	7.2.5
Uncontrolled Airspace		
Class G airspace in the Beatty Corridor	Small piston-engine aircraft, helicopters, and gliders	7.2.7

DOE = Department of Energy, EC = Electronic Combat

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APPENDIX A

CIVILIAN AND MILITARY ACCIDENTS IN THE REGIONAL SETTING AND SELECTED MILITARY ACCIDENTS

Civilian aircraft accidents are shown in Table A-1; Air Force aircraft accidents identified in Section 6, Figure 6-4, are shown in Table A-2, as well as additional events not shown on Figure 6-4. A criterion for selection of these accidents includes a pilot and/or passenger fatality. Several of the later events were preliminary reports, but were added for completeness.

Table A-1. Civilian Aircraft Accidents from 1993 to 2003

Rec. #	FAA Part ^a	Event Date	City
1	091	19-Jun-93	HENDERSON
2	135	12-Jul-93	LAS VEGAS
3	091	19-Nov-93	LAS VEGAS
4	091	24-Sep-94	LAS VEGAS
5	091	03-Dec-94	NORTH LAS VEGAS
6	091	25-Sep-97	SANDY VALLEY
7	091	03-Apr-99	INDIAN SPRINGS
8	091	20-Aug-99	LAS VEGAS
9	135	14-Oct-99	NORTH LAS VEGAS
10	091	28-Apr-00	NORTH LAS VEGAS
11	091	29-Aug-00	LAS VEGAS
12	091	13-Oct-00	HENDERSON
13	091	19-May-01	NORTH LAS VEGAS
14	091	30-Oct-01	MT CHARLESTON
15	091	26-Jan-02	NORTH LAS VEGAS
16	091	04-Apr-03	NORTH LAS VEGAS
17	091	19-May-03	JEAN
18	091	14-Dec-03	TONOPAH
19	091	25-Dec-03	NORTH LAS VEGAS

NOTE: ^aFAA Part 91 is General Aviation, FAA Part 135 is Air Taxi and Commuter
Source: Ragan 2004a [DIRS 168113].

Table A-2. Air Force Class "A" Accidents in Nevada, 1993-2003

Record #	Mishap ID	Aircraft	Mishap Base	Mishap Latitude ^a	Mishap Longitude ^a	Mishap Description
1	320775	N/A	Nellis AFB NV	360030N	1152755W	Controlled flight into or toward terrain
2	321406	F-16	Nellis AFB NV	365925N	1144020W	Loss of control - Inflight
3	321594	F-16	Nellis AFB NV	373012N	1161616W	Controlled flight into or toward terrain
4	321789	F-16	Nellis AFB NV	371106N	1152624W	Controlled flight into or toward terrain
5	322073	F-16	Nellis AFB NV	363520N	1154000W	Controlled flight into or toward terrain
6	324376	Unknown	Nellis AFB NV	361500N	1150100W	Abnormal runway contact
7	325405	Unknown	Nellis AFB NV	372136N	1151130W	Undershoot/overshoot
8	300524	HH-60	Nellis AFB NV	365530N	1154004W	Midair/near midair collision
9	301262	F-15	Nellis AFB NV	375500N	1160100W	Midair/near midair collision
10	301320	Unknown	Nellis AFB NV	361400N	1150100W	System/component failure or malfunction (powerplant)
11	302356	F-15	Nellis AFB NV	375100N	1154100W	Loss of control - Inflight
12	302372	F-16	Nellis AFB NV	365844N	1143107W	Midair/near midair collision
13	304019	Unknown	Nellis AFB NV	365450N	1134941W	Controlled flight into or toward terrain
14	305391	F-15	Nellis AFB NV	374600N	1150200W	System/component failure or malfunction (powerplant)
15	305489	A-10	Nellis AFB NV	372615N	1162353W	Unknown
16	306405	F-15	Nellis AFB NV	370402N	1143623W	Midair/near midair collision
17	323337	Unknown	Tonopah AFS NV	375419N	1165006W	System/component failure or malfunction (non-powerplant)
18	Unknown	A-10	Nellis AFB NV	3645N	11527W	Unknown. Accident occurred 11/2003

NOTE: ^aFormat is, for example, 360030N for 36° 00' 30" N

Sources: McGregor 2004 [DIRS 168121], Wood 2004 [DIRS 169894], pp. 6-7.

APPENDIX B

AIRCRAFT USED IN NEVADA TEST AND TRAINING RANGE

B.1 Aircraft Operating in Military Airspace

Aircraft and their missions that are currently or projected to be operational within the NTTR are identified in this appendix. The NTTR airspace used for the different missions flown by each aircraft is discussed. The aircraft, missions, and aircraft configurations represent the ongoing activities in the NTTR.

The Sally Corridor is the primary access path to the MOAs, and to the military designated restricted areas, and lies to the east of the MGR. Some flights return from these areas west of the MGR to the Beatty Corridor. The USAF instructions in *Flying Operations, Local Operating Procedures* (USAF 2005 [DIRS 176948], Chapter 6) provide direction for resolving abnormal events within the restricted areas for events occurring in these areas.

B.2 Current Aircraft and Research and Development Aircraft

Primary aircraft operating in the military airspace are shown in Table B-1 (USAF 1999 [DIRS 103472], Appendix A.3). Aircraft types operating in the airspace include rotary wing, fixed wing, and remotely operated aircraft (USAF 1999 [DIRS 103472], pp. 1-45 to 1-50). Aircraft activities performed by the USAF, U.S. Navy, and U.S. Army include simulated combat, combat support, combat service support training, weapons testing, and research and development. The research and development activities may include aircraft types not yet identified. Combat service support training, weapons testing, and research and development aircraft have been identified as possible aircraft that may be used in future NTTR operations (USAF 1999 [DIRS 103472], Section 1.6.2).

Table B-1. Aircraft In Nevada Test And Training Range Military Operations Areas

Aircraft	Mission	Altitude	Airspace Used	Airspeed	Weapon Configurations	Tasks
F-15C Eagle	Aircraft Handling Characteristics	5,000 ft AGL to 30,000 ft MSL	MOAs	0 KCAS to mach 1.0	None	Maneuverability exercises
	Basic Fighter Maneuvers	10,000 ft AGL to 30,000 ft MSL	MOAs	0 KCAS to mach 1.0	One Air Intercept Missile (AIM)-9M, chaff/flares	Maneuverability exercises
	Air Combat Maneuvers	10,000 ft AGL to 50,000 ft MSL	MOAs, or 60 series and Alamo	0 KCAS to mach 1.1	One AIM-9M, chaff/flares	Aircraft intercept against various adversary formations and tactics
	Step Down Training	300 ft AGL to 20,000 ft MSL	MOAs or Alamo and 60 series, or 70 series	0 KCAS to mach 1.0	One AIM-9M, chaff/flares	Demonstrate proficiency in low altitude offensive and defensive tasks
	Tactical Intercepts	300 ft AGL to 50,000 ft MSL	MOAs, 70 series and ECRs	0 KCAS to mach 1.5	One AIM-9M, chaff/flares	Perform two- and four- ship intercept missions against various formations and tactics
	Night	10,000 ft AGL to 50,000 ft MSL	70 series, ECRs, and MOAs	0 KCAS to mach 1.5	One AIM-9M, chaff/flares	Four-versus-four intercepts in an area defense mode
	Dissimilar Air Combat Tactics	300 ft AGL to 50,000 ft MSL	MOAs and 70 series	0 KCAS to mach 1.5	One AIM-9M, chaff/flares	Perform point defense scenarios and employ ordnance
	Mission Employment	300 ft AGL to 50,000 ft MSL	MOAs, 70 series, and ECRs	0 KCAS to mach 1.5	One AIM-9M, chaff/flares	Plan a composite strike force with six-ship plus unknown number of friendly aircraft, adversaries, and bombers with electronic countermeasures (ECM)
F-15E Strike Eagle	Advanced Handling Characteristics	5,000 ft AGL to 30,000 ft MSL	MOAs	0 KCAS to mach 1.0	Captive AIM-9	Maneuverability exercises

Aircraft	Mission	Altitude	Airspace Used	Airspeed	Weapon Configurations	Tasks
	Basic Fighter Maneuvers	5,000 ft AGL to 30,000 ft MSL	MOAs	0 KCAS to mach 1.0	Captive AIM-9, chaff/flares	Maneuverability exercises
	Tactical Intercepts	500 ft AGL to 40,000 ft MSL	MOAs and 70 series	0 KCAS to mach 1.0	Captive AIM-9, chaff/flares	Perform one-, two- and four-ship low altitude intercepts against various formations and tactics
	Air Combat Maneuvering/Air Combat Tactics	500 ft AGL to 40,000 ft MSL	MOAs, 70 series, and ECRs	0 KCAS to mach 1.0	Captive AIM-9, chaff/flares	Aircraft intercept against various adversary formations and tactics
	Surface Attack	75 ft AGL to 25,000 ft MSL	60 or 70 series	350 KCAS to 600 KCAS	Mix of various weapons, chaff/flares	Various weapons deliveries
	Surface Attack Tactics	75 ft AGL to 25,000 ft MSL	70 series and ECRs	350 KCAS to 600 KCAS	Mix of various weapons, chaff/flares	Aircraft intercept against various adversary formations and tactics
	Weapons	75 ft AGL to 25,000 ft MSL	60 or 70 series	350 KCAS to 600 KCAS	Mix of various weapons, chaff/flares	Various weapons deliveries
	Mission Employment	300 ft AGL to 30,000 ft MSL	MOAs, 70 series, ECRs	350 KCAS to mach 1.0	Mix of various weapons, chaff/flares	Tactical ingress of a coordinated strike package, reaction to airborne and surface threats, delivery of inert ordnance, and tactical egress.

Aircraft	Mission	Altitude	Airspace Used	Airspeed	Weapon Configurations	Tasks
F-16 Falcon	Advanced Handling Characteristics	5,000 ft AGL to 30,000 ft MSL	60 Series and MOAs	0 KCAS to mach 1.0	Captive AIM-9	Airborne systems check, G-awareness exercise, gun tracking exercise, local area orientation, and low approach at Indian Springs Air Force Auxiliary Field
	Basic Fighter Maneuvers	5,000 ft AGL to 30,000 ft MSL	MOAs	0 KCAS to mach 1.0	Captive AIM-9, flares	Gun and missile exercises, one-versus-one maneuvering
	Tactical Intercepts/Air Combat Maneuvering	500 ft AGL to 40,000 ft MSL	MOAs	0 KCAS to mach 1.0	Captive AIM-9, chaff/flares	Single/multiple ship intercepts against low altitude aircraft
	Air Combat Tactics	500 ft AGL to 50,000 ft MSL	MOAs	0 KCAS to mach 1.3	Captive AIM-9, chaff/flares	Defend a specified point from four-to-six adversaries
	Surface Attack	500 ft AGL to 30,000 ft MSL	60 series or 70 series and ECRs	350 KCAS to 550 KCAS	Mix of various weapons	Weapons deliveries
	Surface Attack Tactics	500 ft AGL to 30,000 ft MSL	60 series or 70 series and ECRs	350 KCAS to 550 KCAS	Mix of various weapons, chaff/flares	Weapons deliveries
	Close Air Support	500 ft AGL to 30,000 ft MSL	60 series	350 KCAS to 550 KCAS	Mix of various weapons, chaff/flares	Attacks
	Weapons	300 ft AGL to 50,000 ft MSL	70 series	350 KCAS to mach 1.2	Mix of various weapons and chaff/flares	Weapons deliveries
	Night	500 ft AGL to 30,000 ft MSL	60 or 70 series	350 KCAS to 550 KCAS	Mix of various weapons, and chaff/flares	Night attacks
	Mission Employment	500 ft AGL to 30,000 ft MSL	70 series and ECRs	350 KCAS to mach 1.2	Mix of various weapons, and chaff/flares	Force employment or defense of a specific area

Aircraft	Mission	Altitude	Airspace Used	Airspeed	Weapon Configurations	Tasks
A/OA-10 Thunderbolt II	Advanced Handling Characteristics	5,000 ft AGL to 25,000 ft MSL	Alamo, 60 series	120 KCAS to 350 KCAS	None	Perform advanced handling maneuvers
	Basic Flight Maneuver	5,000 ft AGL to 25,000 ft MSL	Alamo, 60 series	120 KCAS to 350 KCAS	Captive AIM-9M, flares	Perform basic flight maneuvers
	Surface Attack	100 ft AGL to 25,000 ft MSL	60 series, 70 series, ECRs	200 KCAS to 400 KCAS	Mix of various weapons, chaff	Attack and surface weapons delivery
	Weapons Employment	100 ft AGL to 25,000 ft MSL	60 series or 70 series and ECRs	200 KCAS to 400 KCAS	Mix of various weapons, chaff/flares	Weapons delivery
	Combat Search and Rescue	100 ft AGL to 20,000 ft MSL	60 series, 70 series, ECRs	200 KCAS to 400 KCAS	Mix of various weapons, flares	Visual and electronic search techniques
	Night	2,000 ft AGL to 20,000 ft MSL	60 series	200 KCAS to 400 KCAS	Mix of various weapons, flares	Demonstrate and instruct basic night weapons deliveries.
	Dissimilar Air Combat Tactics / Defensive Low Altitude Air-to-Air Training	300 ft AGL to 25,000 ft MSL	MOAs or 60 series	120 KCAS to 450 KCAS	Captive AIM-9M, chaff/flares	Demonstrate and instruct maneuvers
	Mission Employment	300 ft AGL to 30,000 ft MSL	MOAs, 70 series and ECRs	300 to 350 KCAS	Mix of various weapons, chaff/flares	Employment of gun, free-fall ordnance

Aircraft	Mission	Altitude	Airspace Used	Airspeed	Weapon Configurations	Tasks
F-16C Falcon CTS/AT Adversary Tactics	Local Area Orientation	10,000 AGL to 50,000 MSL	70 series, MOAs	200 KCAS to mach 1.2	Captive AIM-9	Local area familiarization and procedures orientation.
	Single Air Combat	10,000 AGL to 50,000 ft MSL	MOAs	200 KCAS to mach 1.2	Captive AIM-9, chaff/flares	Introduce formations, basic offensive and defensive maneuvers, and gun exercises
	Element Air Combat	10,000 AGL to 50,000 ft MSL	MOAs	200 KCAS to mach 1.2	Captive AIM-9, chaff/flares	Employ element offensive maneuvers against single bandit
	Low Altitude Step Down Training	500 AGL to 30,000 ft MSL	MOAs	200 KCAS to mach 1.2	Captive AIM-9, chaff/flares	Demonstrate low altitude maneuvers, pursuit, and weapons employment
	Element Combat Tactics	10,000 AGL to 50,000 ft MSL	MOAs	200 KCAS to mach 1.2	Captive AIM-9, chaff/flares	Practice basic formations and tactics

Aircraft	Mission	Altitude	Airspace Used	Airspeed	Weapon Configurations	Tasks
United States Air Force Weapons School HH-60G Pave Hawk Helicopter	Day /Night Familiarization	Surface to 1,000 AGL	60 series and Indian Springs (Creech)	0 to 140 KCAS	Forward Looking Infrared, M-60	Day and Night familiarization of flying area and procedures
	Navigation Systems Operations	Surface to 1,000 AGL	60 series	0 to 140 KCAS	Forward Looking Infrared, M-60	Demonstrate proficiency with enhanced systems
	Basic Helicopter Maneuvers	Surface to 1,000 AGL	60 series, MOAs	0 to 140 KCAS	None	Helicopter maneuvers and two-ship maneuvers
	Defensive Maneuvering Ground	Surface to 1,000 AGL	70 series	0 to 140 KCAS	Forward Looking Infrared, mix of various weapons	Demonstrate ability to evade electronic threats
	Defensive Maneuvering Air	Surface to 1,000 AGL	60 series, MOAs	0 to 140 KCAS	Forward Looking Infrared, mix of various weapons, chaff	Defensive and offensive maneuvers
	Combat Search and Rescue Task Force Scenario	Surface to 1,000 AGL	60 series and Alamo	0 to 140 KCAS	Forward Looking Infrared, M-60, chaff	Instruct search and rescue
	Mission Employment	Surface to 1,000 AGL	70 series and ECRs	0 to 140 KCAS	Forward Looking Infrared, M-60, chaff	Instruct search and rescue
66 Rescue HH-60G Pave Hawk Helicopter	Air-to-Ground	Surface to 1,000 AGL	60 series	0 to 140 KCAS	Forward Looking Infrared, M-60	Rescue
	Electronic Combat	Surface to 1,000 AGL	70 series and ECRs	0 to 140 KCAS	Forward Looking Infrared, M-60, chaff	Electronic combat and repelling
	Low-Level Navigation Training	Surface to 200 AGL	MOAs	0 to 140 KCAS	Forward Looking Infrared, M-60	Low-level training and repelling
	Air Refueling Training	1,000 ft AGL to 6,000 ft MSL	Mormon Mesa AR Track (not on map)	115 KCAS	Unknown	Air refueling
B-52 Stratofortress	Red/Green Flag, Mission Employment/ Strike Phase	300 AGL to 39,000 ft MSL	MOAs, 60 and 70 series, ECRs	340 to 420 KTAS	Simulated bombs and missiles	Transition to Series 60/70 ranges

AGL = above ground level, AIM = Air Intercept Missile, KCAS = knots calibrated airspeed, KTAS = knots true airspeed, MSL = mean sea level

Source: USAF 1999 [DIRS 103472], Appendix A Table 3.1 and Appendix A.3.

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APPENDIX C

NEVADA TEST AND TRAINING RANGE

C.1 Nevada Test and Training Range

The NTTR includes airspace, land, and infrastructure dedicated to military uses. The lands dedicated to military uses and the airspace of the NTTR are composed of the Desert and Reville MOAs and five restricted areas of the NTTR: R-4806E, R-4806W, R-4807A, R-4807B, and R-4809 (USAF 1999 [DIRS 103472], Appendix A, Section 2.1). R-4809 airspace, including R-4809A was changed from the DOE, as the using agency, to the USAF, Headquarters Air Warfare Center, Nellis Air Force Base, Nevada, on October 30, 2003 (14 CFR 73 [DIRS 173133], Airspace Docket No. 03-AWP-6).

C.1.1 Military Operations Areas

Military airspace includes MOAs and restricted airspace. Restricted airspace may be designated as joint use, whereby non-participating civilian or military aircraft may be routed through this airspace by air traffic control when there is no conflict with scheduled activities. If not designated as joint use, non-participating aircraft are normally not permitted at any time.

The Desert and Reville MOAs (Section 6, Figure 6-1) are used for conducting air-to-air intercept training, which consists of high altitude operations, abrupt maneuvers, and supersonic flight at and above 5,000 ft AGL. The base of each MOA is 100 ft AGL. The ceiling is up to 18,000 ft MSL; nevertheless, ATCAA can be provided on an as-needed basis by the FAA to extend airspace from 18,000 ft MSL to higher altitudes needed to accommodate flight training requirements (USAF 1999 [DIRS 103472], pp. 3.1-4 and 3.1-5).

C.1.2 Reville Military Operations Area

The Reville MOA airspace comprises the northern portion of the NTTR and is normally controlled by the FAA Salt Lake ARTCC. Nellis must schedule use of this airspace in advance since it includes FAA jet routes and federal airways used for east-west transit of IFR traffic (USAF 1999 [DIRS 103472], pp. 3.1-4 and 3.1-5).

Use of the ATCAA airspace above 18,000 ft MSL requires 11 days advance notice because of civilian air traffic; therefore, military air traffic is generally located below 18,000 ft MSL unless large mission employment exercises need additional airspace for staging purposes per *Weapons Range Management* (USAF 1996 [DIRS 157987], Sections 1.2.3.2 and 1.2.3.3). The closest boundary of the Reville MOA is about 71 miles from the North Portal (NIMA 2001 [DIRS 158638] and NACO 2003a [DIRS 168126], as measured).

C.1.3 Desert Military Operations Area

The Desert MOA is the eastern half of the NTTR and is active with military traffic during daylight hours Monday through Saturday, and by Notice to Airmen during other hours (USAF 1999 [DIRS 103472], pp. 3.1-4 and 3.1-5). Training will generally occur between 300 ft AGL and 50,000 ft MSL and is divided into the following four subsections:

- **Sally Corridor (Sally Area on Figures 6-1 through 6-4)** is a transition route between Nellis AFB and portions of the NTTR (USAF 1996 [DIRS 157987], Section 1.2.4.2.5). The closest boundary of the Sally corridor to a repository surface facility is about 64 miles (NIMA 2001 [DIRS 158638]).
- **Elgin** is primarily an air-to-air training area and contains the Nellis training range, where, flight maneuvers for real-time flight monitoring are recorded through a system of aircraft transmitters and ground receivers that can be replayed for flight debriefing. The area is normally entered and exited via the Sally Corridor (USAF 1999 [DIRS 103472], Appendix A, Section 2.1). The closest boundary of the Elgin MOA to a repository surface facility is about 88 miles (NIMA 2001 [DIRS 158638]).
- **Caliente** is primarily an air-to-air training area with west entry/exit via the Sally Corridor and east entry/exit via MTRs or the Sally Corridor (USAF 1999 [DIRS 103472], Appendix A, Section 2.1). The closest boundary of the Caliente MOA to a repository surface facility is about 84 miles (NIMA 2001 [DIRS 158638]).
- **Coyote** provides airspace for tactical training maneuvers (USAF 1999 [DIRS 103472], Appendix A, Section 2.1). The closest boundary of the Coyote MOA to a repository surface facility is about 55 miles (NIMA 2001 [DIRS 158638]).

C.2 Restricted Areas

Within the NTTR, restricted areas R-4806, R-4807, and R-4808S are joint use while R-4808N and R-4809 are not joint use. The restricted areas of the NTTR are divided into the North Range and the South Range. These two ranges are separated by the NTS (USAF 1999 [DIRS 103472], pp. 1-16 to 1-21 and 3.1-3).

C.2.1 North Range

The North Range is approximately 1.8 million acres of withdrawn land. It contains four unmanned weapons delivery sub ranges, three ECRs, the Tonopah Test Range, and Pahute Mesa. (USAF 1999 [DIRS 103472], pp. 1-16 to 1-21)

A description of the target and threat sites can be found in USAF (1996 [DIRS 157987], Chapter 1, Sections C and D). The sub-ranges are described in Sections C.2.1.1 to C.2.1.3 (USAF 1999 [DIRS 103472], pp. 1-16 to 1-21 and 3.1-3).

C.2.1.1 R-4807A

R-4807 is divided into R-4807A and R-4807B. R-4807A includes the 70 Series ranges and the ECRs and is divided into several subsections, as follows (USAF 1999 [DIRS 103472], Figure 2-1, and pp. A-8 and A-9):

- **Range 71** is located in the northwest corner of R-4807A and contains aircraft targets (USAF 1999 [DIRS 103472], pp. A-8 and A-9). The closest boundary to a repository surface facility is about 52 miles (NIMA 2001 [DIRS 158638]).

- **Range 74** is located in the eastern portion of R-4807A and contains aircraft targets (USAF 1999 [DIRS 103472], Figure 2-1, and pp. A-8 and A-9). The closest boundaries to a repository surface facility are about 32 miles (NIMA 2001 [DIRS 158638]).
- **Range 75** is located in the central portion of R-4807A and contains numerous targets consisting of missile sites, convoys, signal platoons, air defense artillery units, infrared targets, and other array targets (USAF 1999 [DIRS 103472], Figure 2-1, and pp. A-8 and A-9). The closest boundary of Range 75 to a repository surface facility is about 34 miles (NIMA 2001 [DIRS 158638]).
- **Range 76** is located in west central R-4807A and contains numerous targets consisting of airfields, missile sites, industrial areas, a railroad complex, convoys, command and control centers, and tank arrays designed for infrared training. Live ordnance is allowed on some targets and inert training ordnance is allowed on all targets. Manned threat emitters are sometimes located in these zones (USAF 1999 [DIRS 103472], Figure 2-1, and pp. A-8 and A-9). The closest boundary of Range 76 to a repository surface facility is about 33 miles (NIMA 2001 [DIRS 158638]).
- **Tolicha Peak** ECR is a manned electronic combat threat simulator range located in the southwest corner of R-4807A . There are no bombable targets and no ordnance is expended on the range (USAF 1999 [DIRS 103472], Figure 2-1 and pp. A-8 and A-9; USAF 1996 [DIRS 157987], Section 1.19). The closest boundary to a repository surface facility is about 28 miles (NIMA 2001 [DIRS 158638]).
- **Tonopah** ECR is a manned electronic combat threat simulator range located in the eastern portion of R-4809 and the northern portion of R-4807A (EC East and EC West) . Aircrews are prohibited from expending ordnance anywhere within the range (USAF 1999 [DIRS 103472], Figure 2-1, and pp. A-8 and A-9). The closest boundary to a repository surface facility is about 58 miles (NIMA 2001 [DIRS 158638]).
- **EC South Range** is an ECR located in the southwest corner of R-4807A. Aircrews are prohibited from dropping any ordnance anywhere within the EC South Range. The eastern area extends from the surface to 13,000 ft MSL to allow overlying corridor above 14,000 ft MSL to transition aircraft from the northern ranges for recovery to Nellis AFB (USAF 1999 [DIRS 103472], Figure 2-1, and pp. A-8 and A-9). The closest boundary of EC South to a repository surface facility is about five miles (NIMA 2001 [DIRS 158638]).

C.2.1.2 R-4807B

R-4807B (Pahute Mesa), which is on the northern border of R-4808N and surrounded on the other sides by R-4807A, is used by DOE as an annex to the NTS, in support of the national nuclear weapons test program, and the USAF uses the airspace for over-flights. Helicopter traffic extends up to 500 ft AGL (USAF 1999 [DIRS 103472], p. A-9; USAF 1996 [DIRS 157987], Section 1.25). The closest boundary of R-4807B to a repository surface facility is about 30 miles (NIMA 2001 [DIRS 158638]).

C.2.1.3 R-4809

R-4809 contains EC threat simulators and equipment used by Sandia Corporation for DOE. The Tonopah Test Range Airfield, located within R-4809A which is in the northwest corner of R-4809, can be used as a divert base for in-flight emergencies (USAF 1996 [DIRS 157987], Section 1.22). The closest boundary of the Tonopah Test Range to a repository surface facility is 58 miles (NIMA 2001 [DIRS 158638] and NACO 2003a [DIRS 168126], as measured).

C.2.2 South Range

The South Range is approximately 1.2 million acres of withdrawn land. It contains five weapons-delivery areas (Ranges 61, 62, 63, 64, and 65) (USAF 1999 [DIRS 103472], Figure 1-7, pp.1-21 and 1-23).

C.2.2.1 R-4806E

R-4806E (Alamo), located west of Sally, is primarily an air-to-air training area with entry and exit via the Sally Corridor. It consists, from north to south, of Alamo Alpha, Alamo Bravo, and Alamo Charlie (USAF 1996 [DIRS 157987], Section 1.18). The closest boundary of the Alamo range to a repository surface facility is about 62 miles (NIMA 2001 [DIRS 158638]).

C.2.2.2 R-4806W

R-4806W contains the 60 Series Ranges and is divided into five major Ranges that are further subdivided, as follows, that are used for conventional bombing and gunnery testing and training (USAF 1996 [DIRS 157987], Sections 1.4 to 1.9). The closest boundary to a repository surface facility is about 27 miles (NIMA 2001 [DIRS 158638] and NACO 2003a [DIRS 168126], as measured).

- Range 61 is in the northeastern corner of R-4806W (USAF 1999 [DIRS 103472], p. A-5). The closest boundary to a repository surface facility is about 49 miles (NIMA 2001 [DIRS 158638]).
- Range 62 is in the eastern section of R-4806W (USAF 1999 [DIRS 103472], p. A-5). The closest boundary to a repository surface facility is about 48 miles (NIMA 2001 [DIRS 158638]).
- Range 63 is composed of 63 and 63A and is in the southeastern section of R-4806W (USAF 1999 [DIRS 103472], pp. A-5 and A-7). The closest boundary to a repository surface facility is about 48 miles (NIMA 2001 [DIRS 158638]).
- Range 64 is composed of 64A, 64B, 64C, and 64D and is in the southwestern section of R-4806W. Range 64A and D are used primarily as training areas for helicopter operations and transition area for aircraft going into Range 65. No ordnance is authorized in R-64A (USAF 1999 [DIRS 103472], p. A-7). The closest boundary to a repository surface facility is about 27 miles (NACO 2003a [DIRS 168126], as measured).

- Range 65 is in the south-central section of R-4806W (USAF 1999 [DIRS 103472], p. A-5). The closest boundary to a repository surface facility is about 36 miles (NIMA 2001 [DIRS 158638]).

C.3 MILITARY TRAINING ROUTES AND AREAS

Military training routes and areas include LATNs and MTRs (NIMA 2001 [DIRS 158638]).

C.3.1 Low Altitude Training Navigation Areas

The LATN areas associated with the NTTR are unrestricted airspace areas established on the east, southwest and central of the NTTR for A-10s and helicopters to practice random selection of navigation points and low altitude tactical formations between 50 and 1,500 ft AGL (USAF 2005, [DIRS 176948], pp. 28 through 30) when airspace may be unavailable within the NTTR. About 40 to 50 sorties are conducted weekly in LATNs by Nellis AFB A-10 units, 75 percent in the southwest LATN. LATNs are not depicted on aeronautical charts; however, local airports and aviation groups have been advised of their existence and associated operations (USAF 1999 [DIRS 103472], p. 3.1-8). LATN west is approximately 1 mile from a repository surface facility (NIMA 2001 [DIRS 158638] and NACO 2003a [DIRS 168126], as measured). LATN East is outside the Regional Setting (over 100 miles). LATN Central is used for helicopters only and is approximately 46 miles from a repository surface facility (NIMA 2001 [DIRS 158638] and NACO 2003a [DIRS 168126], as measured).

C.3.2 Military Training Routes

Military training routes permit military flight training at airspeeds in excess of 250 knots below 10,000 ft MSL while providing training in low altitude tactics and navigation (USAF 1999 [DIRS 103472], pp. 3.1-5 to 3.1-8). MTRs are established as IFR routes (IRs) or visual flight rules (VFR) routes (VRs). MTRs in the region have floor segments as low as 100 ft AGL, but they are normally flown between 500 and 1,000 ft AGL (USAF 1999 [DIRS 103472], pp. 3.1.5 and 3.1.8). There are approximately 21 different MTRs transiting within or immediately adjacent to the NTTR, five MTRs exist within NTTR restricted airspace. Table C-1 is a reproduction of the information provided in USAF (1999 [DIRS 103472], Table 3.1-1, p. 3.1-8) and identifies the five routes, the scheduling agency, and the portion of the route within restricted airspace, the estimated annual sorties, and the closest distance to the North Portal.

Table C-1. Military Training Routes that Access Nevada Test and Training Range

MTR	Scheduling Agency	NTTR Airspace Accessed	Estimated Annual Sorties	Approximate Distance to North Portal^a (miles)
IR-286	Nellis AFB	Final segment in R-4806W	21	15
VR-222	Nellis AFB	Final segment in R-4807	550	11
VR-1214	Edwards AFB	Last segment enters R-4807	300	18
IR 279	Offutt AFB	Last segment provides an entry point to R-4809	115	72
IR 282	Mountain Home AFB	Last segment provides an entry point to R-4807	12	77

NOTE: ^a Approximate distances to North Portal were determined from NACO 2003a [DIRS 168126], as measured.

AFB = Air Force Base, IR = instrument route, MTR = military training route, NTTR = Nevada Test and Training Range, VR = Visual Route

Source: USAF 1999 [DIRS 103472], Table 3.1-1, p. 3.1-8, NACO 2003a [DIRS 168126].

Some of the MTR routes may be used when ingressing/egressing NTTR range target areas during routine training and exercise. Detailed descriptions of MTRs are provided in *Area Planning, Military Training Routes, North and South America* (DOD 2002 [DIRS 158435]). The section of VR-222 due west of the North Portal is limited to a maximum altitude of 1,500-ft AGL, which represents a deviation from the normal maximum altitude for a three-digit MTR identification (DOD 2002 [DIRS 158435], p. 2-38).

C.4 R-2508 Complex

A large area of airspace, referred to as the R-2508 Complex, exists to the west and southwest of Yucca Mountain and is composed of MOAs and ATCAAs. The R-2508 Complex includes the airspace and associated land presently used and managed by Edwards AFB, National Training Center, Fort Irwin, and the Naval Air Warfare Center Weapons Division, China Lake (USAF 2001a [DIRS 158243], Section 2.3). The airspace is divided both horizontally and vertically with MOAs being overlapped by ATCAAs and restricted areas. The MOAs and ATCAAs combine with R-2508 to form four major work areas. Peripheral areas, made up of MOAs and ATCAA airspace, increase the size of the usable airspace (USAF 2001a [DIRS 158243], Section 7.1.2). Typical operations within the R-2508 Complex include (USAF 2001a [DIRS 158243], Section 7.2):

- Aircraft research and development in all stages of flight
- Operational weapons test and evaluation flights
- Student pilot training
- Air combat maneuvering and proficiency flights
- Civilian test aircraft in direct support of U.S. Department of Defense and/or defense training.

C.4.1 R-2508 Complex Military Operations Areas

The four major MOAs within the lateral boundaries of the R-2508 Complex include Isabella (about 95 miles from the North Portal), Owens (about 78 miles from the North Portal), Saline (about 35 miles from the North Portal) and Panamint (about 36 miles from the North Portal) (USAF 2001a [DIRS 158243], Section 7.1.2, and NACO 2003a [DIRS 168126], as measured).

C.4.2 R-2505

R-2505 airspace is restricted on a continuous basis and is subdivided into five primary ranges. The primary mission of these ranges is the research, development, testing, and evaluation of weapons and weapons systems (USAF 2001a [DIRS 158243], Section 6.2). The closest edge of R-2505 is about 70 miles from the North Portal (NACO 2003a [DIRS 168126], as measured).

C.4.3 R-2524

R-2524 airspace is restricted on a continuous basis. This area includes an ECR that provides a simulated hostile land and sea surface-to-air weapons installation. Targets are available for inert ordnance only (USAF 2001a [DIRS 158243], Sections 6.4 and 6.5). The closest edge of R-2524 is about 79 miles from the North Portal (NACO 2003a [DIRS 168126], as measured).

C.4.4 R-2502

R-2502 is part of the National Training Center controlled by Fort Irwin (USAF 2001a [DIRS 158243], Section 6.1). Aircraft must be in contact with and under control of Fort Irwin. The closest edge of R-2502 is about 79 miles from the North Portal (NACO 2003a [DIRS 168126], as measured).

C.5 R-2508 COMPLEX PERIPHERAL AREAS

Two peripheral areas within the R-2508 Complex are located within the 100-mile regional setting of Yucca Mountain. These include: Deep Springs ATCAA (56 miles from the North Portal), which provides additional work areas for segregation of military operations from IFR traffic, and Shoshone MOA (200 ft AGL to FL180)/ATCAA (FL180 to FL600) (about 31 miles from the North Portal) (NACO 2003a [DIRS 168126], as measured) with activities including operational testing and evaluation, air combat maneuvering, low altitude training, and large-scale exercises (USAF 2001a [DIRS 158243], Section 5.8).

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APPENDIX D

CIVILIAN, FEDERAL, AND MILITARY AIRPORTS

A number of airports or airfields are located within the regional setting of Yucca Mountain (Section 6, Figures 6-2 and 6-3). These include military, DOE, and civilian airports.

D.1 Military Airports

There are three military airports within 100 miles of Yucca Mountain (Section 6, Figure 6-3).

D.1.1 Creech Air Force Base

Creech Air Force Base (formally Indian Springs Air Force Auxiliary Field), located on the southern boundary of R-4806, provides basing for unmanned aerial vehicle operations, aircraft staging support, and emergency/divert recovery for NTTR operations. It is also the primary training location for the Thunderbirds Air Demonstration Squadron (USAF 1999 [DIRS 103472], p. A-11; and USAF 2005 [DIRS 176948], pp. 1 and 93). Table 6-4 (Section 6) lists the flight operations of approximately 4,000 per year. The airfield is about 45 miles from the North Portal (NACO 2003a [DIRS 168126], as measured).

D.1.2 Tonopah Test Range Airfield

There were 200 flight operations for the Tonopah Test Range Airfield for 2003 (Ragan 2004b [DIRS 167809]). The Tonopah Test Range Airfield is about 66 miles from the North Portal (NACO 2003a [DIRS 168126], as measured).

D.1.3 Nellis Air Force Base

Nellis AFB is surrounded by the Las Vegas airspace. Total operations during 2003 for Nellis AFB were 32,400 (Ragan 2004b [DIRS 167809]). The Nellis AFB is about 90 miles from the North Portal (NACO 2003a [DIRS 168126], as measured).

D.2 U.S. Department of Energy Airfields

There are three DOE airports within the 100-mile regional setting of Yucca Mountain (Section 6, Figure 6-3). As discussed in Sections D.2.1 to D.2.3, activity at the NTS airfields has been minimal since the moratorium on underground nuclear testing.

D.2.1 Desert Rock Airport

Small commuter aircraft that fly staff and equipment to and from various national laboratories and the NTS use the Desert Rock Airport. Helicopters based on the NTS also use this airfield (Ragan 2004b [DIRS 167809]). The Desert Rock Airport is about 27 miles from the North Portal (NACO 2003a [DIRS 168126], as measured). Table 6-4 indicates approximately 4,700 operations per year (Ragan 2004b [DIRS 167809]).

D.2.2 Pahute Mesa Airstrip

Pahute Mesa Airstrip is currently used infrequently (Ragan 2004b [DIRS 167809]). The Pahute airfield is about 18 miles from the North Portal (NACO 2003a [DIRS 168126], as measured).

D.2.3 Yucca Airstrip

The Yucca Airstrip has been unused since 1995 (Langendorf 2002 [DIRS 158247]). The Yucca Strip is about 20 miles from the North Portal (NACO 2003a [DIRS 168126], as measured).

D.3 Civilian Airports and Airfields

Several civilian airports and airfields are within 100 miles of the North Portal. Existing facilities range from small private landing strips to a major international airport. Aircraft activity ranges from 0 to more than 0.5 million operations per year (Ragan 2004b [DIRS 167809]). Section 6, Figure 6-2, identifies the location of each of these facilities. High-volume facilities are located to the south of Yucca Mountain in or near Las Vegas. Five airports or airfields, based within reasonable proximity to Yucca Mountain or have high operational levels, were selected for detailed discussion in Sections D.3.1 to D.3.5.

D.3.1 Beatty Airport

The Beatty Airport, located on the outskirts of Beatty, is a public facility owned by Nye County, Nevada. The airport serves approximately four locally owned single-engine aircraft as well as air taxi service for Beatty and Death Valley National Park.

The Beatty Airport does not have a control tower and is unattended. Pilots are expected to be in radio contact with other aircraft in the area and to use visual flight rules during takeoffs and landings (Gorski 2004 [DIRS 170589]; Ragan 2004b [DIRS 167809]). The Beatty Airport is about 21 miles west of the North Portal (NACO 2003a [DIRS 168126], as measured).

D.3.2 Furnace Creek Airport

The Furnace Creek Airport, located in Death Valley National Park, is a public facility owned by the U.S. Department of Interior, National Park Service. The airport serves two locally owned single-engine aircraft. Single wheel weight limitation is 4,000 lbs. The runway is only 3,065 ft long limiting operations to small aircraft. The Furnace Creek Airport does not have a control tower and is unattended. Pilots are expected to be in radio contact with other aircraft in the area and to use visual flight rules during takeoffs and landings (Ragan 2004b [DIRS 167809]). The Furnace Creek Airport is about 37 miles southwest of the North Portal (NACO 2003a [DIRS 168126], as measured).

D.3.3 Inyere Airfield

The Inyere Airfield, located in Amargosa Valley, is a private facility owned by IMV, a division of the Floridin Company. The airport serves approximately one locally owned single-engine aircraft. The Inyere airfield is not paved and is only 2,600 ft long. Because the Inyere Airfield is privately owned, it is reasonable to forecast that the annual operations are expected to remain

approximately the same as current operations. The Invite Airfield does not have a control tower but is attended between 7:00 a.m. and 5:30 p.m. (Ragan 2004b [DIRS 167809]). Pilots are expected to be in radio contact with other aircraft in the area and to use visual flight rules during takeoffs and landings. The Invite Airfield is about 28 miles south of the North Portal (NACO 2003a [DIRS 168126], as measured).

D.3.4 McCarran International Airport

The McCarran International Airport, located in Las Vegas, Nevada, is a public facility owned by Clark County, Nevada.

McCarran has a control tower attended at all times and is surrounded by the Las Vegas airspace, which is a class of airspace that is characteristic of any airport environment having a high volume of air traffic (Ragan 2004b [DIRS 167809]). This irregular shaped airspace extends from 20-25 nautical miles south and east of Las Vegas/Nellis AFB to the southern boundary of the Desert MOA (Sally Corridor) (NACO 2003a [DIRS 168126], as measured). Aircraft entering or transiting through this charted airspace must be in contact with, and under the positive control of, either Nellis or McCarran radar approach/departure control facilities. The positive protective nature of this airspace enhances flight safety of civilian aviation transiting through this high air traffic density area. McCarran is about 89 miles east-southeast of the North Portal (NACO 2003a [DIRS 168126], as measured). McCarran International is a Terminal Control Area or Class B Airspace requiring special equipment on all aircraft flying into the McCarran International airspace (NACO 2003a [DIRS 168126]).

D.3.5 North Las Vegas Airport

The North Las Vegas Airport, located in North Las Vegas, Nevada, is a public facility owned by Clark County, Nevada.

The North Las Vegas Airport has a control tower attended between 5:30 a.m. and 9:30 p.m. (Ragan 2004b [DIRS 167809]). The North Las Vegas Airport is surrounded by the Las Vegas airspace. The North Las Vegas Airport is about 82 miles east-southeast of the North Portal (NACO 2003a [DIRS 168126], as measured).

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APPENDIX E

INSTRUMENT FLIGHT RULES ENROUTE LOW AND HIGH ALTITUDE ROUTES IN THE REGIONAL SETTING

Low Altitude Airways (Victor Airways). Victor Airways are “highways” utilized by both IFR and VFR traffic. These routes are 8 nautical miles wide and generally have a base altitude of 1,200 ft AGL up to but not including 18,000 ft MSL. The airway floor varies to ensure that aircraft operating on the airway remain clear of ground obstructions and have the ability to receive the radio signals from the navigational facilities. These airways are depicted on aeronautical charts as blue shaded lines with a “V,” hence the term Victor, followed by a number, for example V-820 (NACO 2003a [DIRS 168126]).

Jet Routes. Jet routes serve the same function as the low altitude airways except that they are found at 18,000 ft MSL and above, up to 45,000 ft MSL. The traffic on a jet route is always operating under IFR and is managed by air traffic control. Jet routes have no specified width. Typical aircraft flying these routes includes airliners, air cargo, corporate jets, and other high performance aircraft (NACO 2003b [DIRS 168129]).

Jet routes and Victor routes are flown from ground radio navigation aids or VORTACs and navigational fixes (ground based non-directional radio beacons). Aircraft fly to or from the VORTACs. “Q” routes were introduced in late 2003 (also known as Area Navigation or RNAV routes). One Q-route is within the regional setting. These routes are designed for high-altitude aircraft flying point-to-point. Route Q13 terminates at the LIDAT navigational fix approximately 61 miles northwest of the North Portal (NACO 2003b [DIRS 168129]).

Table E-1 lists the low-and-high altitude routes in the regional setting of Yucca Mountain and distances from the North Portal.

Table E-1. Instrument Flight Rules Low-and-High Altitude Routes

Jet Routes and Federal Airways	Approximate Centerline Distance from North Portal (miles)
J-9	86
J-58/J-80	82
J-72	88
J-76	88
J-86	14
J-92	11
J-100	86
J-110	41
J-146	86
J-148	95
V-105	16
V-135	16
V-244	85
V-394	88
V-538	89
Q13	61

Sources: NACO 2003a [DIRS 168126], for V routes, as measured. NACO 2003b [DIRS 168129], for J routes, as measured, and NACO 2003c [DIRS 168128], for Q Routes, as measured.

A few of the jet routes and federal airways closest to the North Portal are discussed below.

E.1 J-110 Jet Route

Route J-110 is an east-west jet route terminating at the Oakland, California, VORTAC via Monterey, California, VORTAC, via Clovis, Nevada, VORTAC, via Boulder City, Nevada, VORTAC and on to the east. Typical flights to/from Oakland and San Francisco, California, and other western cities to Las Vegas, and beyond, fly this route. A portion of the route crosses the R-2508 complex. This portion of J-110 is normally unavailable to aircraft during daylight hours Monday through Friday (NACO 2003b [DIRS 168129]).

E.2 J-86 Jet Route

Route J-86 starts at the Beatty, Nevada, VORTAC, intersects with J-110 at the FUZZY fix west of the Boulder City, Nevada, VORTAC, and generally heads to the southeast to El Paso, New Mexico, VORTAC and beyond. The centerline distance from the North Portal is approximately 14 miles (NACO 2003b [DIRS 168129], as measured). The FAA allows flights to use the entire width between R-2508 and R-4808/R-4807 (Shively 2002 [DIRS 158250]). Therefore, the closest point that aircraft can fly in this jet route is about 6 miles, which is the closest distance from the North Portal to the R-4808S boundary (Section 6, Table 6-1).

E.3 J-92 Jet Route

Route J-92 continues toward the Coaldale, Nevada, VORTAC and then on to Reno, Nevada (Section 6, Figure 6-2). The centerline distance from the North Portal is approximately 11 miles (NACO 2003b [DIRS 168129], as measured). According to the FAA, civilian aircraft are allowed to use the airspace between the R-2508 and R-4800 restricted areas (Shively 2002 [DIRS 158250]). Therefore, the closest point aircraft can fly in this jet route is about 6 miles, which is the closest distance from the North Portal to the R-4808S boundary (Section 6, Table 6-1).

E.4 V-105/135 Airway

This airway begins south of the NTS, heads northwest paralleling the NTTR, and splits off (Section 6, Figure 6-2). V-105 continues to the Coaldale, Nevada, VORTAC and then on to Reno, Nevada. V-135 heads northeast and terminates at the Tonopah Airport. The centerline distance from the North Portal is approximately 16 miles (NACO 2003c [DIRS 168128], as measured).

APPENDIX F

NATURAL BARRIERS (MOUNTAINS)

NIMA (2001 [DIRS 158638]) identifies natural barriers for the North Portal. For the LATN areas to the west and VR-222 to the west, the Yucca Mountain ridgeline provides a visual separation from the valley where military flights occur. Also, as the LATN and VR-222 are limited to flights below 1,500 ft and are typically flown at 500 ft to 1,000 ft AGL, the Yucca Mountain ridgeline provides a natural barrier to aircraft crash hazards (DOD 2002 [DIRS 158435], p. 2-38; and USAF 2005, [DIRS 176948, pp. 28 through 30).

The record of flight activity from the FAA (Ragan 2002 [DIRS 160817]) does not count all of the flights below 10,000 ft MSL, where an undetermined number of general aviation flights are conducted. Of these, some are below 1,200 ft AGL in uncontrolled Class G airspace. At this altitude above the valley floor to the west or southwest of Yucca Mountain (NIMA 2001 [DIRS 158638]) at Crater Flat (elevation up to 4,000 ft), an airplane would still be below the crest of Yucca Mountain (around 4,800 ft). Therefore, there is no hazard to the Yucca Mountain facilities from general aviation aircraft below 1,200 ft to the west or southwest.

The elevation of the Yucca Mountain facilities is about 3,700 ft (NIMA 2001 [DIRS 158638]). Five or more miles to the south of the North Portal in the southwest corner of the NTS (R-4808S) is an area around Fortymile Wash (elevation up to 3,000 ft) where aircraft flying at 1,200 ft AGL could be higher in altitude and possibly in view of the Yucca Mountain facilities. However, civilian use of R-4808S is not permitted below FL200 (that is, below about 20,000 ft MSL) (USAF 1996 [DIRS 157987], Section 1.27). Therefore, civilian air traffic below 10,000 ft MSL in the lower reaches of Fortymile Wash is at least 11 miles from the North Portal (NIMA 2001 [DIRS 158638]). Moreover, there is a number of obstructions, such as Busted Butte to the south of the North Portal (elevation 4,266 ft) and Little Skull Mountain to the southeast of the North Portal (elevation 4,666 ft) that help reduce the possibility of an aircraft impacting North Portal facilities from the lower reaches of Fortymile Wash (elevation below about 2,800 ft) (NIMA 2001 [DIRS 158638]). North of Busted Butte and south of the North Portal, Fran Ridge runs north and south at about 3,800 ft elevation and provides additional protection from aircraft to the southeast of the site. The great distance and topographical obstructions that separate the southern reaches of Fortymile Wash from the Yucca Mountain site make it difficult for an accident initiated there at an altitude below 1,200 ft AGL to terminate in a crash into the Yucca Mountain facilities.

Civilian flight is not permitted in R-4808N (USAF 1996 [DIRS 157987], Section 1.1). While civilian flight is technically permitted in EC South under limited circumstances (USAF 1996 [DIRS 157987], Sections 1.1 and 1.24), there is very little civilian traffic in the area. Subsequently, the hazard posed by general aviation aircraft below 1,200 ft AGL near Yucca Mountain is negligible.

Military flights below 10,000 ft MSL are conducted on military training routes VR-222, VR-1214, and IR-286. These military training routes are normally flown between 500 ft and 1,000 ft AGL. The section of VR-222 due west of the North Portal has a maximum altitude of 1,500 ft

AGL. VR-1214 is also limited to 1,500 ft AGL (DOD 2002 [DIRS 158435], p. 2-129). This places the aircraft low enough that the topographic barriers previously discussed will severely limit any hazard they might otherwise pose to Yucca Mountain surface facilities. The altitude variation between the MGR ridgeline above the North Portal and the centerline of the VR-222 MTR is approximately 1,400 ft (the valley floor just east of the MTR is 3,459 ft and the crest of the Yucca Mountain ridge line is 4,846 ft), providing a natural barrier to deviant aircraft flying the MTR and providing a well-defined flight path through the valley to the west of the Yucca Mountain ridgeline for VFR flight. Military flights below 10,000 ft, therefore, do not pose a hazard to the MGR.